

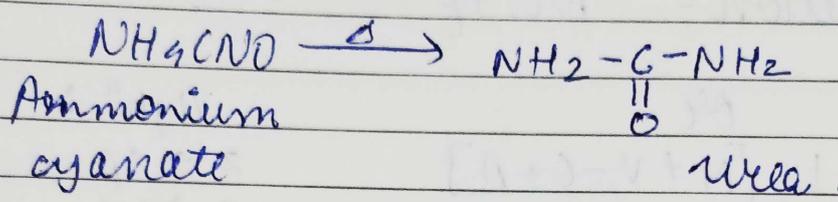
6/1/25

# Ch-8 - Organic Chemistry

## Some Basic Principles & Techniques:-

\* Organic Chemistry:- Hydrocarbons & their derivatives are known as organic compound.

→ Formation of urea:-

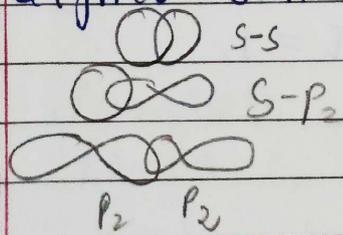


### Hydrocarbon (C+H)

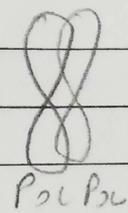
Saturated		Unsaturated	
→ C-C			
→ Single - Bond		Alkene	Alkyne
→ $C_n H_{2n+2}$		→ $C=C$	$C \equiv C$
→ Hybridisation :- $sp^3$		→ $C_n H_{2n}$	$C_n H_{2n-2}$
→ Shape :- Tetrahedral		→ Hyb :- $sp^2$	$sp$
→ % s → 25%		→ Shape :- planar	linear
→ Suffix :- 'ane'		→ % s = 33.3%	50%
→ Alkanes		→ Suffix = ene	yne

→  $- < = < \equiv$  y strong

→ Sigma bond "\sigma"



→  $\pi$ -bond



% s character & electronegativity

-OH  $\rightarrow$  Alcohol  
 -X [F, Cl, Br, I] Halogen  
 -CHO  $\rightarrow$  Aldehyde  
 $\begin{array}{c} \text{O} \\ \parallel \\ \text{C} \\ | \\ \text{H} \end{array} \rightarrow$  Ketone

-COOH  $\rightarrow$  Carboxylic acid  
 $\begin{array}{c} \text{O} \\ \parallel \\ \text{C} \\ | \\ \text{OH} \end{array}$   
 carbon not shown in bond line

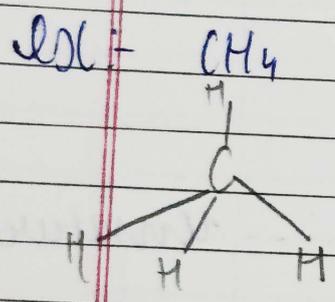
Catenation  
 C-C-C-C-C

Tetrawalency  
 (+) 4 valency  
 Makes bond  $\rightarrow$  N, H, O, S, F

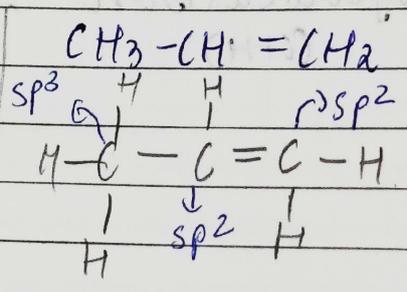
\* Hybridisation = No. of  $\sigma$  bond + lone pair

Hybn:  $\frac{1}{2} [M + V - C + A]$

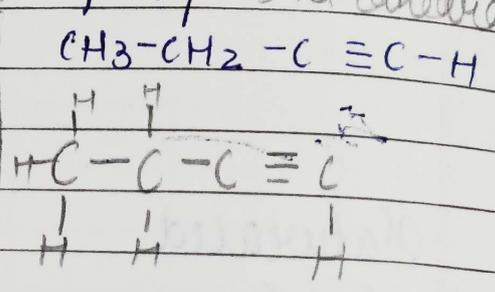
Hyb<sup>n</sup>  $\rightarrow$   
 2  $\rightarrow$  sp  
 3  $\rightarrow$  sp<sup>2</sup>  
 4  $\rightarrow$  sp<sup>3</sup>  $\rightarrow$  tetrahedral



- $\rightarrow \sigma = 4$
- $\rightarrow$  lone pair = 0
- $\rightarrow$  Hyb  $\rightarrow$  sp<sup>3</sup>
- $\rightarrow$  Tetrahedral

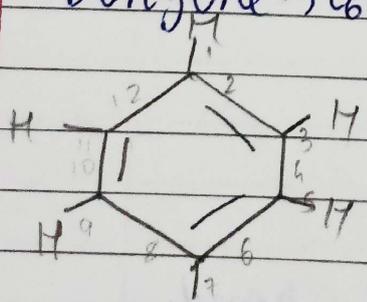


$\sigma = 8, \pi = 1$



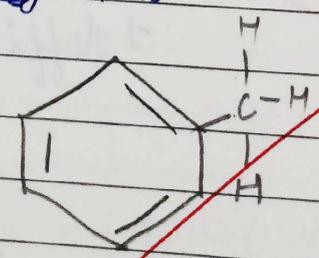
$\sigma = 9, \pi = 2$

Ex: Benzene  $\rightarrow$  C<sub>6</sub>H<sub>6</sub>



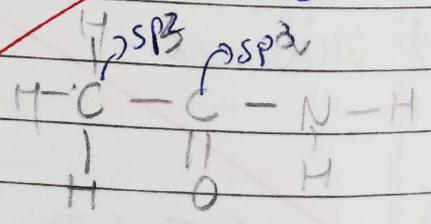
- $\rightarrow \sigma = 12$
- $\rightarrow \pi = 3$
- $\rightarrow$  Hybn  $\rightarrow$  sp<sup>2</sup>

Ex: C<sub>7</sub>H<sub>8</sub>

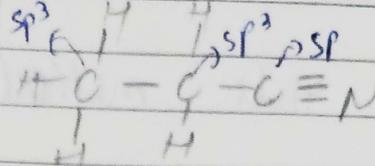
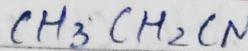
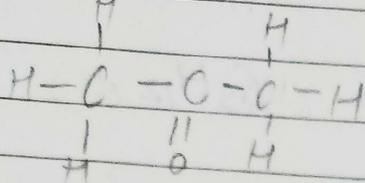
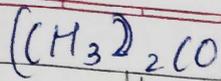


$\sigma = 15$   
 $\pi = 3$

CH<sub>3</sub>CONH<sub>2</sub>



$\sigma = 8$   
 $\pi = 1$



\*

### Formula (compound)

Molecular Formula

empirical formula

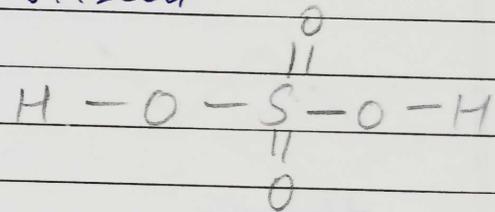
Structural formula

- 1) Molecular formula :-  
 →  $CO_2$   
 →  $H_2O$   
 →  $C_6H_{12}O_6$

→  $CaCO_3$

2) Structural formula

→  $H_2SO_4$



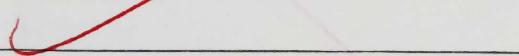
- 2) Empirical formula :-  
 → Minimum ratio :-  
 ex :-  $C_6H_{12}O_6 \rightarrow CH_2O$   
 $C_4H_8 \rightarrow CH_2$   
 $C_6H_6 \rightarrow CH$

### Structural Representation :-

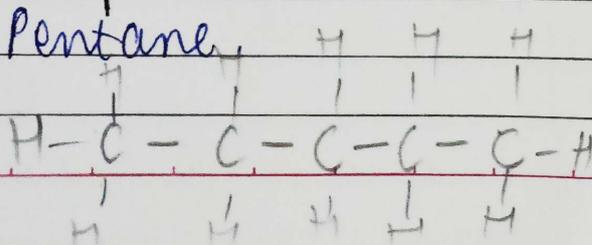
1) Complete structure

2) Condensed structure

3) Bond-line structure



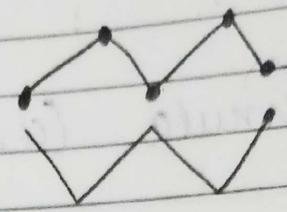
1) Complete structure :-



all  $\sigma$  &  $\pi$  bond lone pair is indicated.

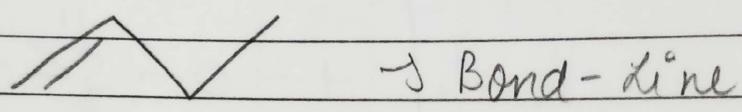
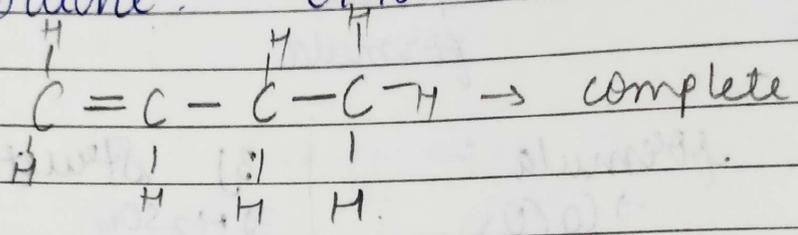
2) Condensed structure :-  
 Pentane  
 Ans in this method is  $C_5H_{12}$

3) Bond-Line structure :-  
 Zig-zag line

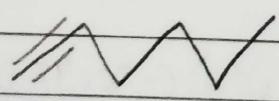
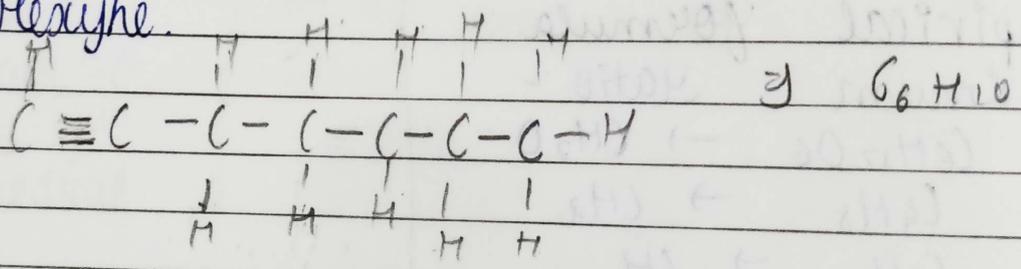


C & H not shown  
 other elements are  
 if terminal is opened  $\therefore CH_3$   
 (methyl group)

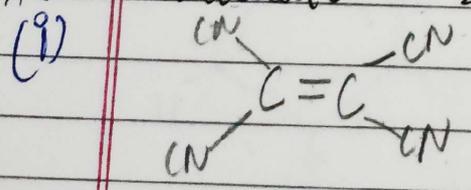
ex:- Butene :-  $C_4H_8 \rightarrow$  condensed



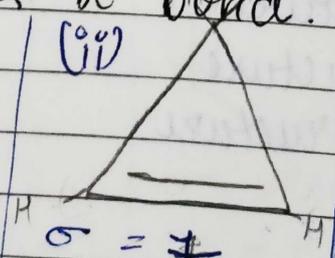
ex:- Hexyne



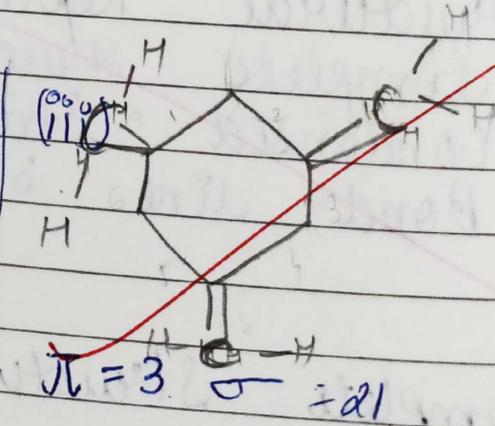
\* Calculate  $\sigma$  &  $\pi$  Bond.



(ii)  
 $\sigma = 9$   
 $\pi = 9$

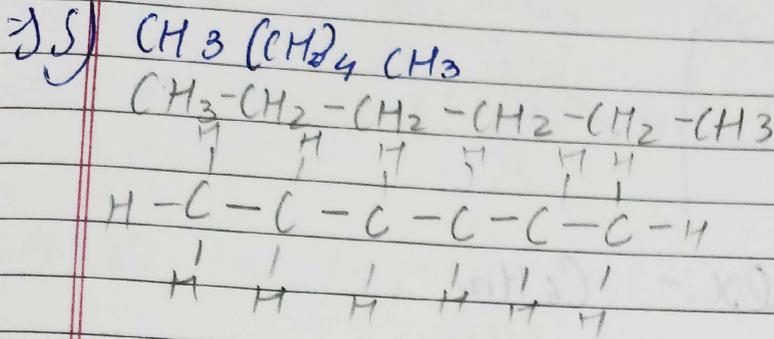
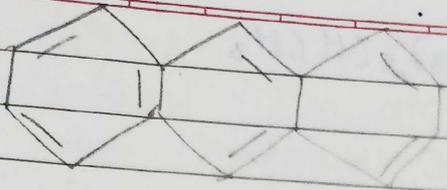


(iii)  
 $\sigma = 7$   
 $\pi = 1$

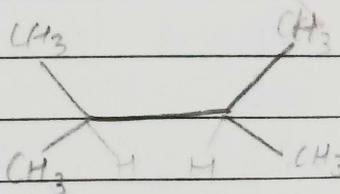
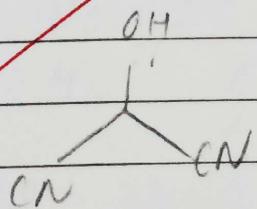
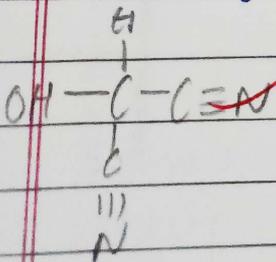
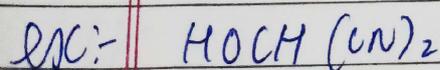
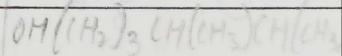
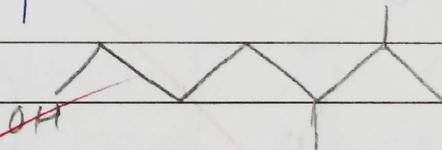
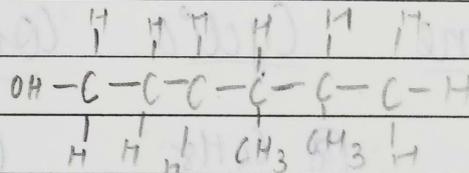
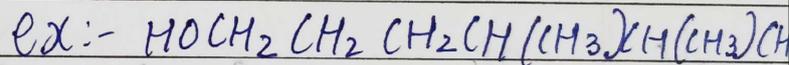
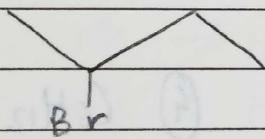
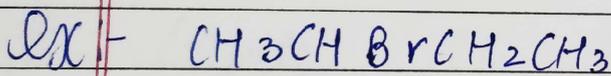
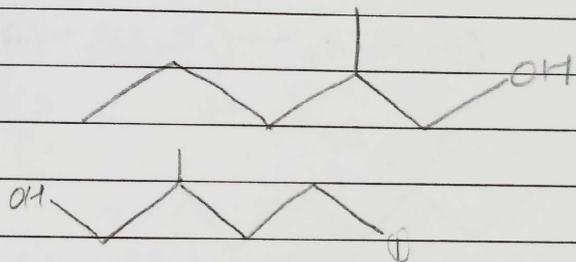
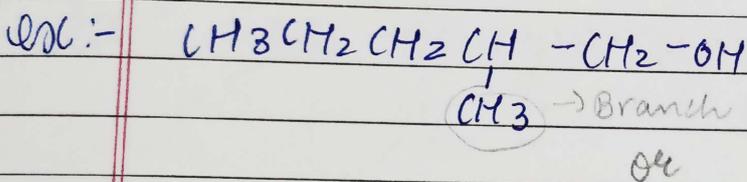
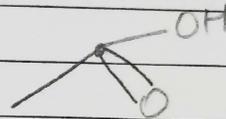
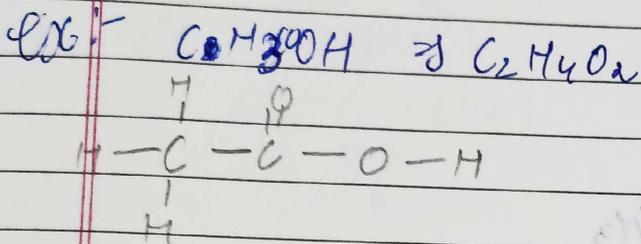


(iv)  
 $\pi = 3$   
 $\sigma = 21$

9)



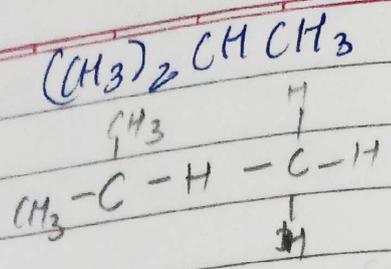
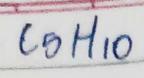
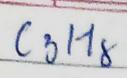
Band line



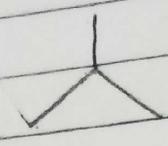
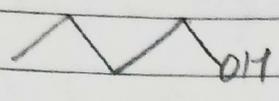
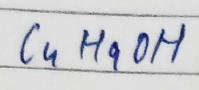
$\sigma = 19.$

$\pi = 0.$

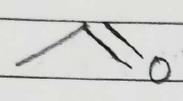
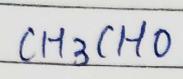
Ex:-



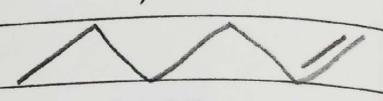
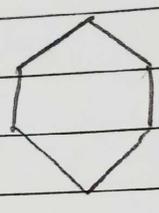
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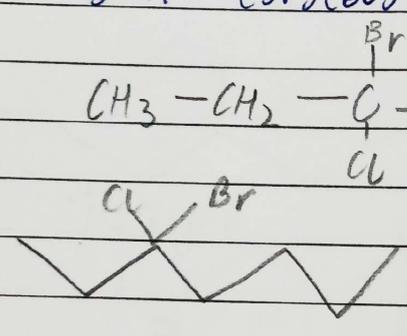
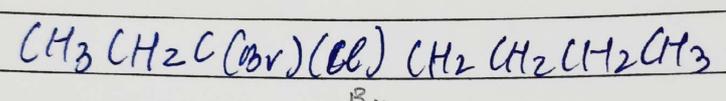
Ex:-



Ex:-  $C_6H_{12}$

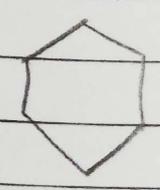
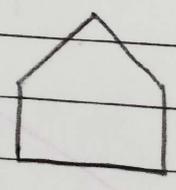
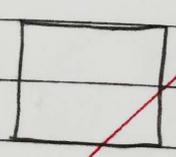
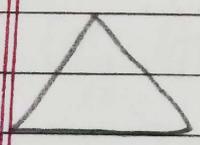


Ex:-

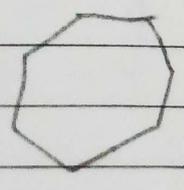


\* Some Cyclic Compound:-

- ①  $C_3H_6$
- ②  $C_4H_8$
- ③  $C_5H_{10}$
- ④  $C_6H_{12}$

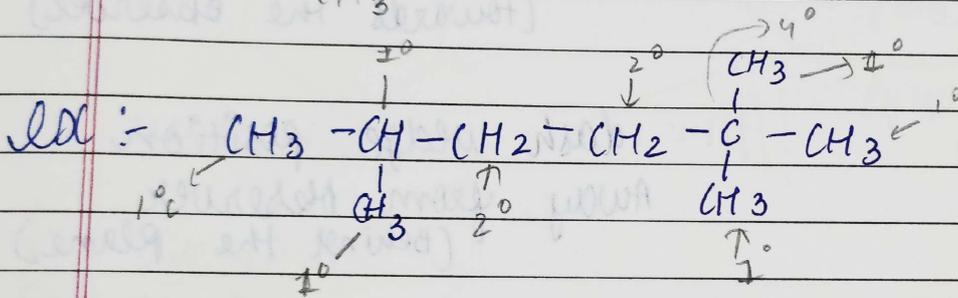
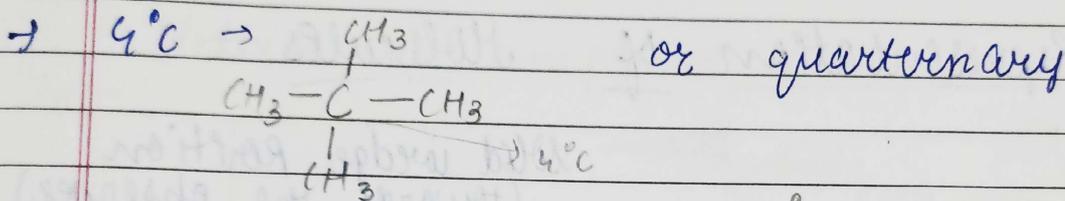
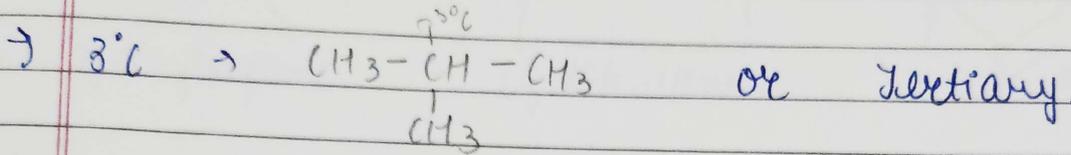
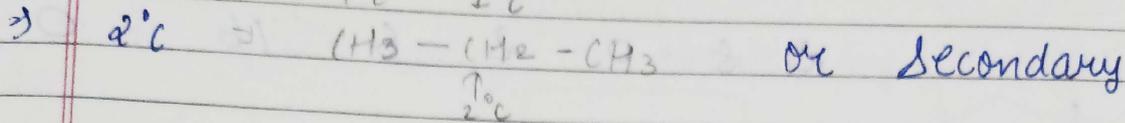
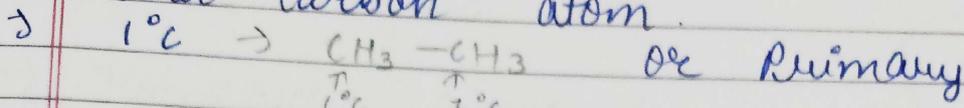


5]  $C_7H_{14}$



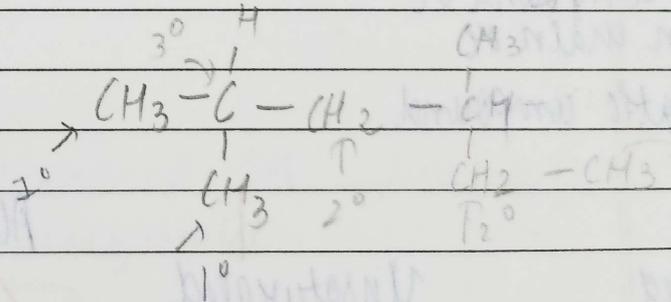
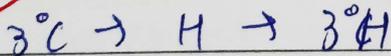
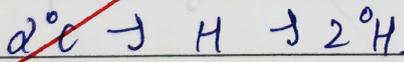
\* Degree of Carbon :-

→ Carbon atom is connected with how many other carbon atom.



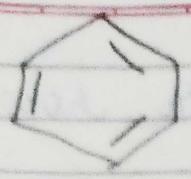
\* Degree of Hydrogen :-

4°HX



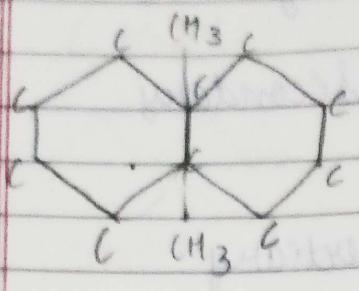
1°C	2°C	3°C	4°C	1°H	2°H	3°H
→ 4	0	0	1	12	0	0

Ex:-



1°	2°	3°	4°	1°H	2°H	3°H
0	6	0	0	0	12	0

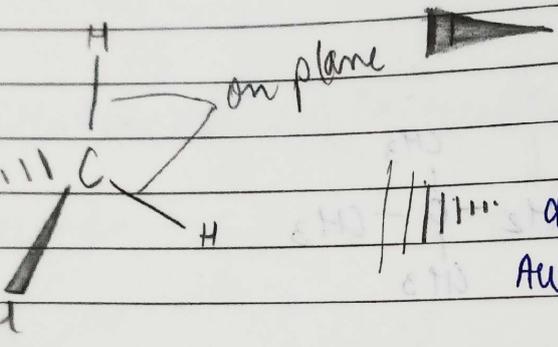
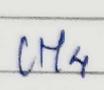
Ex:-



2	8	0	2	6	16	0
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### \* 3-D Representation of Molecules :-

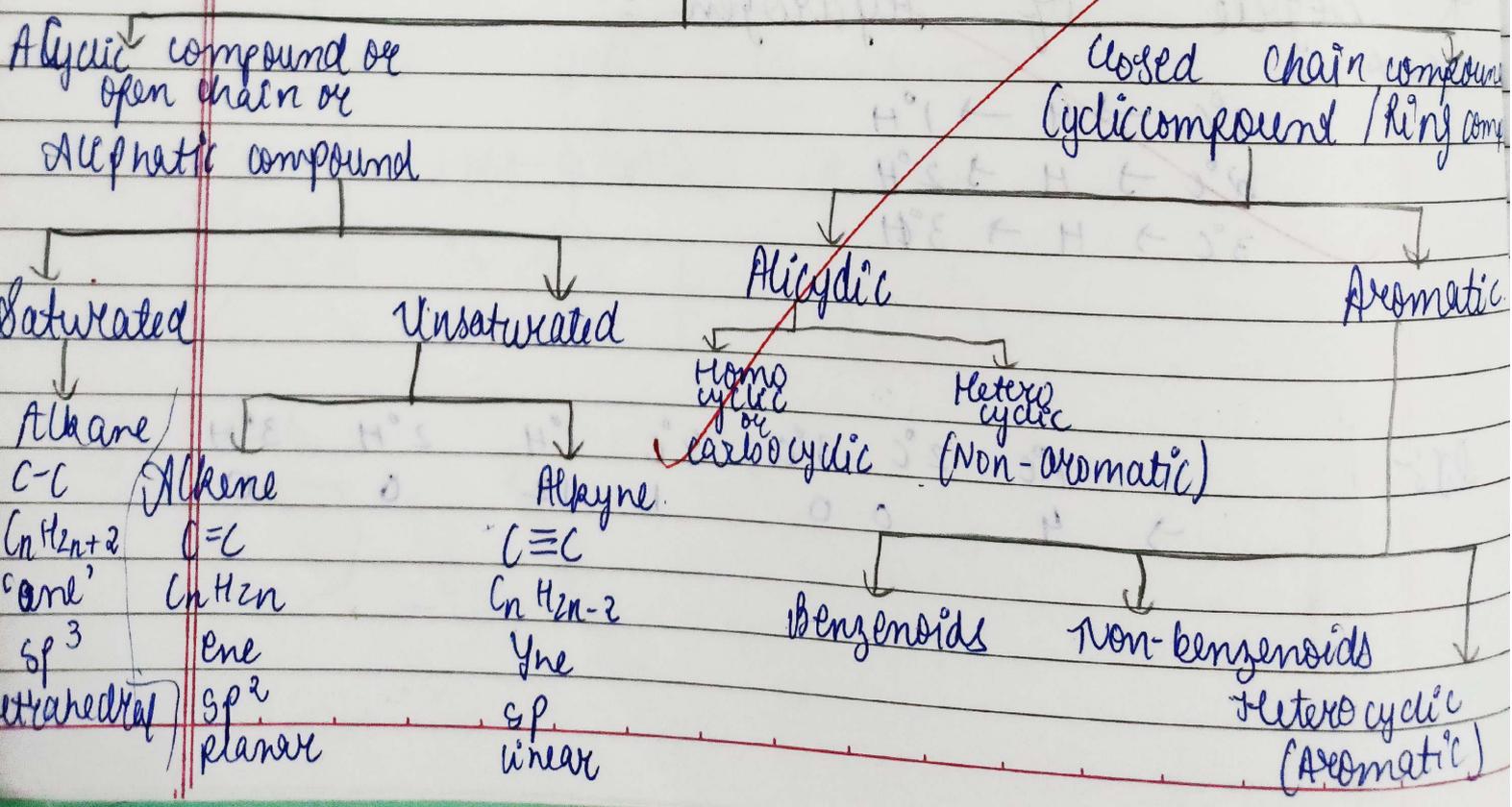
Ex:-



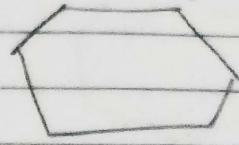
solid wedge position  
(towards the observer)

dash wedge position  
Away from observer  
(behind the plane)

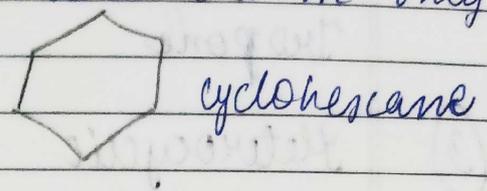
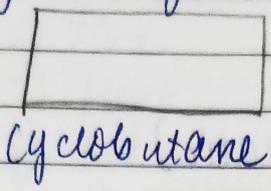
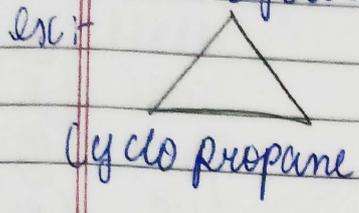
### \* Classification of Organic Compound



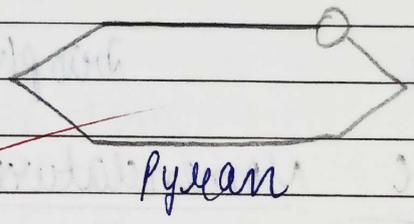
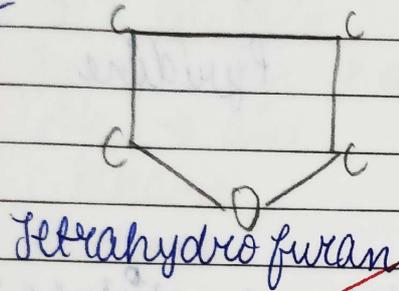
\* Alicyclic compound :-  
 → Carbon is attached with another carbon & form cyclic ring.



→ Homocyclic compound :-  
 → A cyclic ring is formed by carbon atom only.



\* Heterocyclic compound (Non-Aromatic)



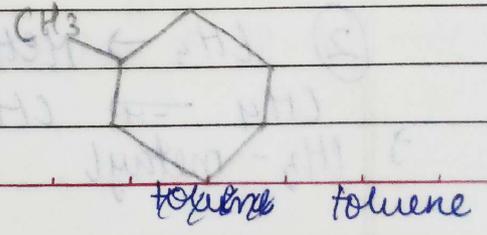
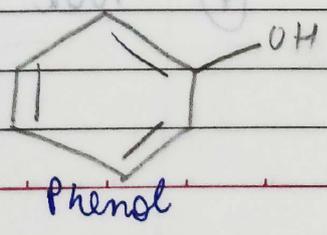
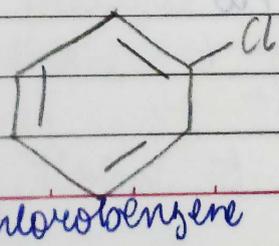
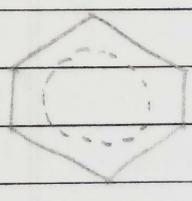
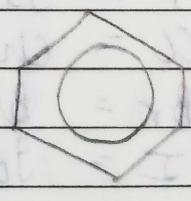
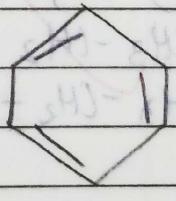
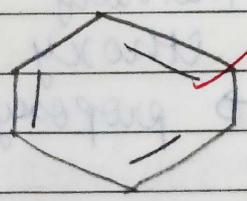
\* Aromatic :-

① Huckel rule :-  $4n+2$ ,  $\pi e^-$  must be present,  
 $n=0, 1, 2, 3$

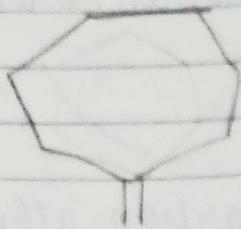
② planar  
 ③ de-localized  $\pi e^-$

① Benzenoid :-

→ This compound is Benzene & its substituted compound are called benzenoids.



② Non-benzenoids :

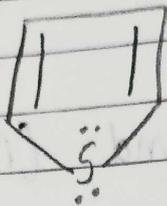


Tropone

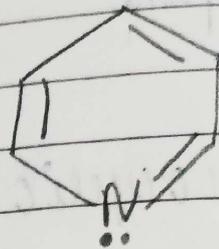
③ Heterocyclic (Aromatic)



Furan



Triophene



Pyridine

\* IUPAC Nomenclature

$2^\circ$  prefix +  $1^\circ$  prefix + word +  $1^\circ$  suffix +  $2^\circ$  suffix  
 $\downarrow$   $\downarrow$   $\downarrow$   $\downarrow$   $\downarrow$   
 branch or cyclic root type of functional group  
 substituent compound No. of carbon bond group  
 -, =,  $\equiv$

$2^\circ$  prefix :-

→ It is branch of carbon  $\text{CH}_3\text{CH}_2$  - ethyl  
 → It is substituent  $\text{CH}_3\text{CH}_2\text{CH}_2$  - propyl

① Halogen (x =)

F = Fluoro  
 Cl = Chloro  
 Br = Bromo  
 I = Iodo

③  $\text{CH}_3\text{-O-}$  → methoxy  
 $\text{CH}_3\text{-CH}_2\text{-O-}$  → ethoxy  
 $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-O-}$  → propoxy

④  $\text{NO}_2$  → Nitro

②  $\text{CH}_4$  → Methane

$\text{CH}_4 \rightarrow \text{CH}_3$

→  $\text{CH}_3$  - methyl

• 1° prefix :-  
 → Cyclic compound  
 → Naming "cyco"

• Word root :-  
 → No. of Carbon present

1) Meth	6) Hex
2) eth	7) Hept
3) prop	8) Oct
4) But	9) Non
5) Pent	10) Dec

• 1° Suffix :-  
 → Types of Bond.

C-C → one	C=C → ene	C≡C → yne
Alkane	Alkene	Alkyne
$C_n H_{2n+2}$	$C_n H_{2n}$	$C_n H_{2n-2}$
CH <sub>4</sub>	C <sub>2</sub> H <sub>4</sub>	C <sub>2</sub> H <sub>2</sub>
C <sub>2</sub> H <sub>6</sub>	C <sub>3</sub> H <sub>6</sub>	C <sub>3</sub> H <sub>4</sub>
C <sub>3</sub> H <sub>8</sub>	C <sub>4</sub> H <sub>8</sub>	C <sub>4</sub> H <sub>6</sub>
C <sub>4</sub> H <sub>10</sub>	C <sub>5</sub> H <sub>10</sub>	C <sub>5</sub> H <sub>8</sub>
C <sub>5</sub> H <sub>12</sub>	C <sub>6</sub> H <sub>12</sub>	C <sub>6</sub> H <sub>10</sub>
C <sub>6</sub> H <sub>14</sub>	C <sub>7</sub> H <sub>14</sub>	C <sub>7</sub> H <sub>12</sub>
C <sub>7</sub> H <sub>16</sub>	C <sub>8</sub> H <sub>16</sub>	C <sub>8</sub> H <sub>14</sub>
C <sub>8</sub> H <sub>18</sub>	C <sub>9</sub> H <sub>18</sub>	C <sub>9</sub> H <sub>16</sub>
C <sub>9</sub> H <sub>20</sub>	C <sub>10</sub> H <sub>20</sub>	C <sub>10</sub> H <sub>18</sub>
C <sub>10</sub> H <sub>22</sub>		

• 2° Suffix

→ Halogen → F, Cl, Br, I

→ Carboxylic → -COOH

→ Aldehyde → -CHO

→ Ketone ⇒  $\begin{matrix} \text{C} & \text{C} \\ // & | \\ \text{O} & \text{O} \end{matrix}$

→ Alcohol → -OH

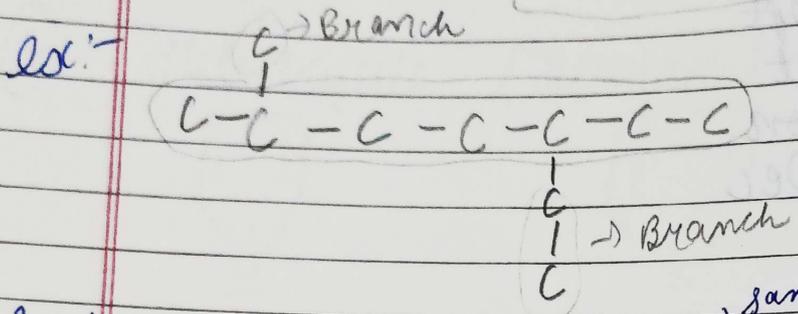
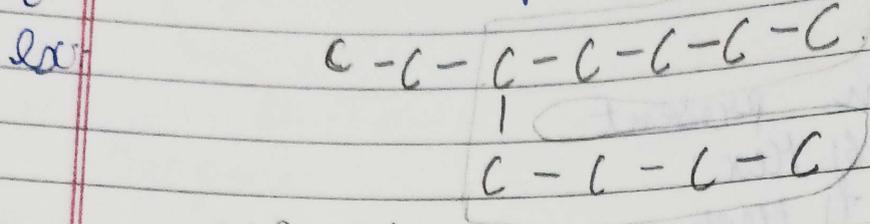
→ ether → R-O-R'

→ ester →  $\begin{matrix} \text{R} & \text{C} & \text{O} & \text{R}' \\ & || & & \\ & \text{O} & & \end{matrix}$

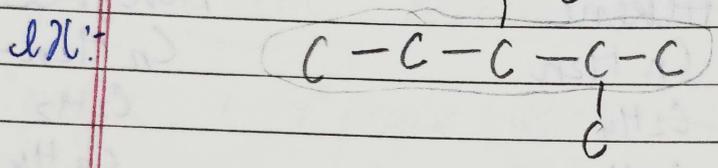
→ Acid chloride →  $\begin{matrix} \text{R} & \text{C} & \text{Cl} \\ & || & \\ & \text{O} & \end{matrix}$

\* Rules for Nomenclature :-

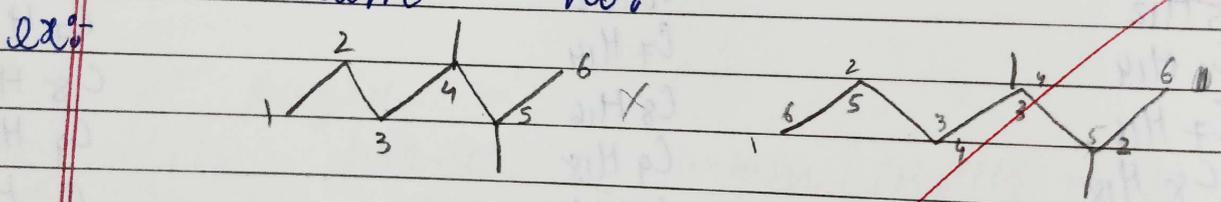
R-1) Find the longest chain of carbon <sup>parent chain</sup>



R-2) when 2 or more carbon chain is present then select the one which has max<sup>m</sup> branches <sup>same no.</sup>



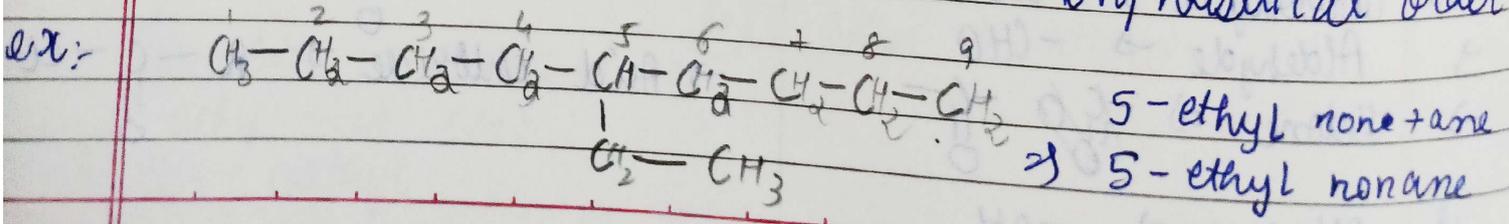
R-3) Numbering of carbon chain should be done in such a way that substituent can get minimum no.



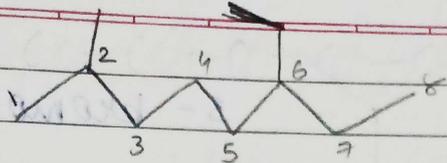
R-4) lowest sum rule :-

$4+5 = 9$   
 $3+4 = 5 \checkmark$

R-5) write name of substituent in alphabetical order



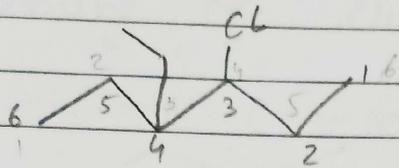
ex:-



→ C<sub>2</sub>H<sub>5</sub> → ethyl  
→ CH<sub>3</sub> → methyl

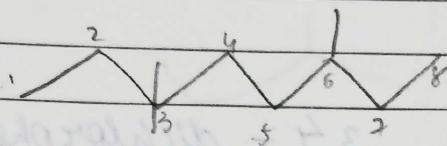
→ 6-ethyl 2-methyl octane

ex:-



→ 4-chloro 3-ethyl hexane ✗  
→ 3-chloro 4-ethyl hexane ✓

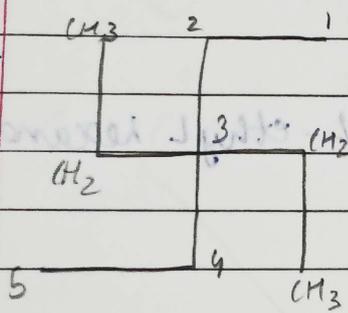
ex:-



→ 3,3,6-trimethyl octane

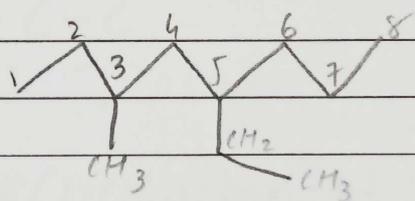
→ 3+3+6 = R ✓  
→ 3+6+6 = 15

sol 4



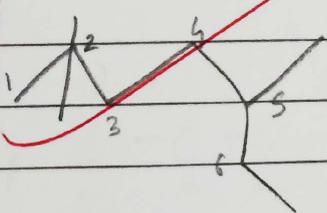
3,3-diethyl pentane

ex:-



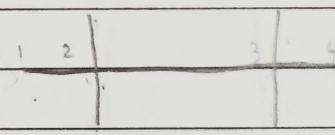
5-ethyl 3-methyl octane

ex:-



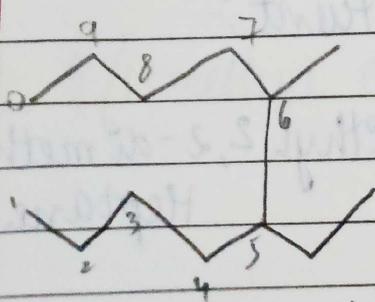
→ 2,2,5-trimethyl heptane

ex:-



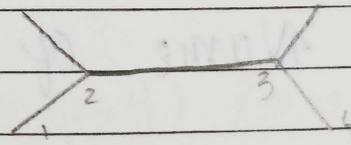
2,2,3,3-tetramethyl butane

ex:-



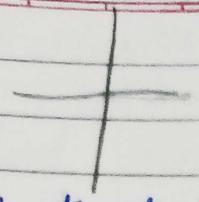
5-ethyl 6-methyl Decane.

ex:-



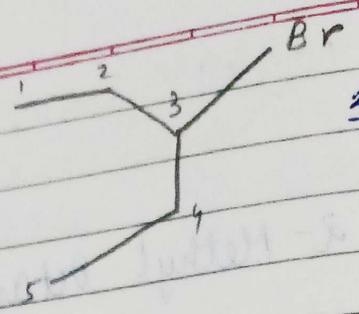
2,3-dimethyl butane

Sol:-



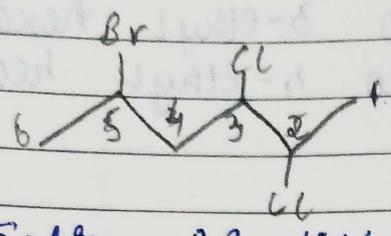
→ 2,2-dimethylpropane

ex:-



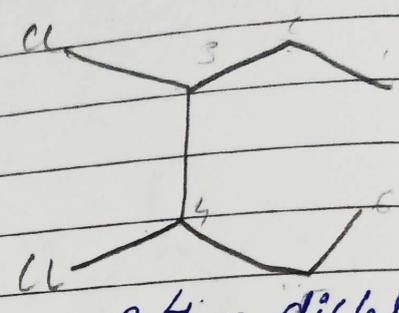
3-bromo pentane

Sol:-



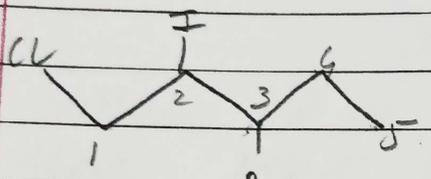
5-bromo 2,3-dichloro hexane

ex:-



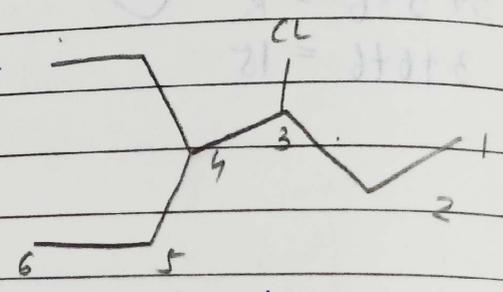
3,4-dichlorohexane

Sol:-



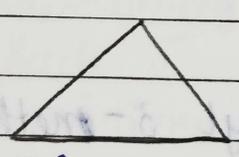
→ 3-bromo 1-chloro 2-iodo pentane

ex:-

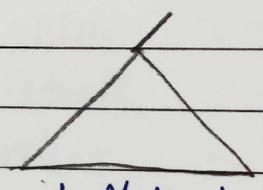


3-chloro 4-ethyl hexane

Sol:-

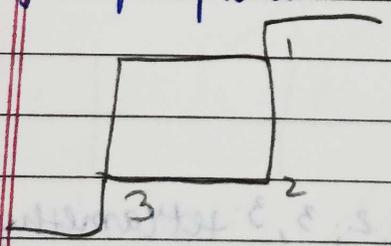


cyclopropane

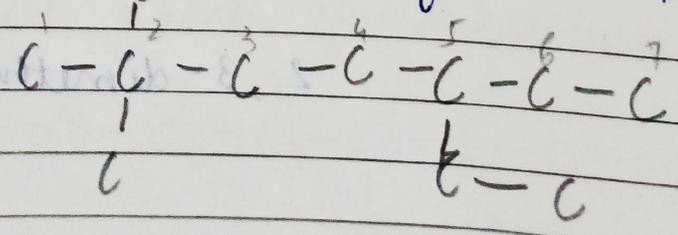


1-Methyl cyclopropane

Sol:-



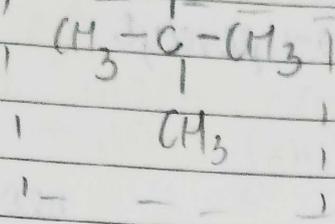
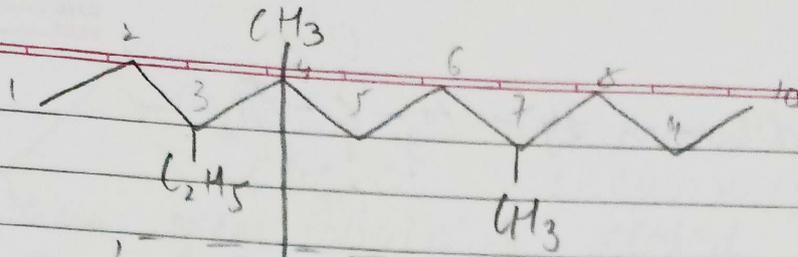
Rule:- Name of different substituent:-



5-ethyl 2,2-dimethyl Heptane

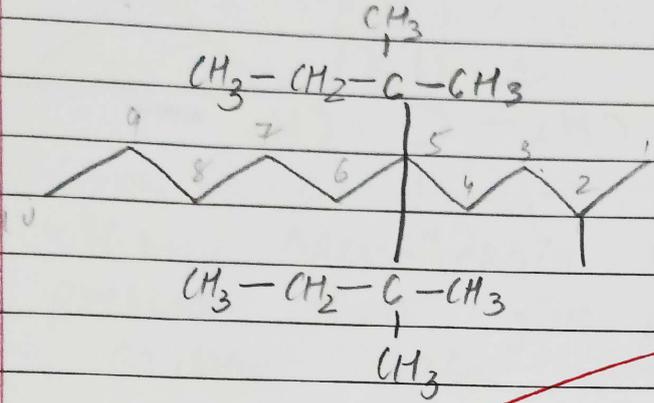






4-(1,1-dimethylethyl)-3-ethyl-4,7-dimethyldecane.  
or  
4-(tert-butyl)-3-ethyl-4,7-dimethyldecane

ex:-

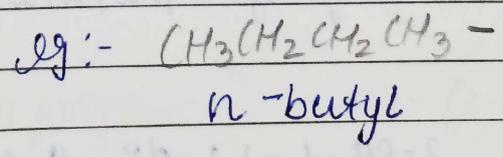
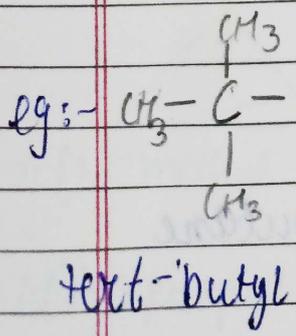
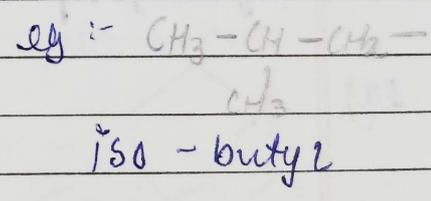
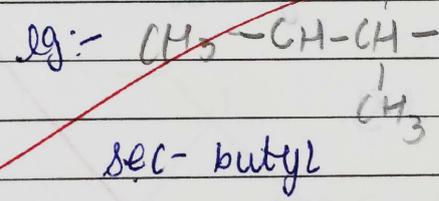
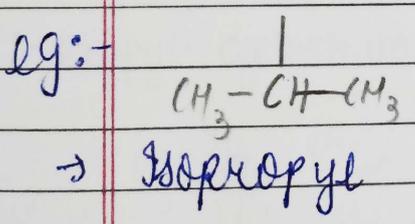


5,5-bis(1,1-dimethylpropyl)-2-methyldecane

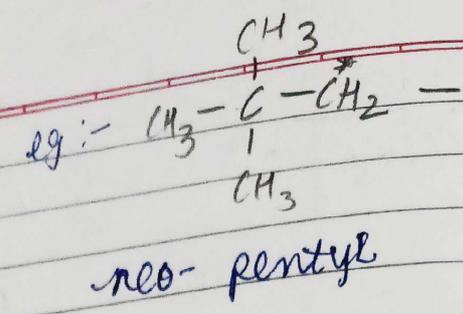
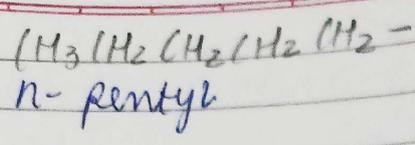
Similar complex

- 2 → Bis
- 3 → Tris
- 4 → Tetra

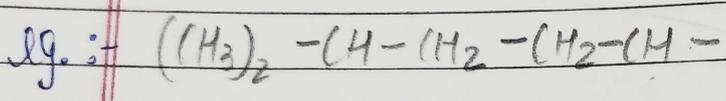
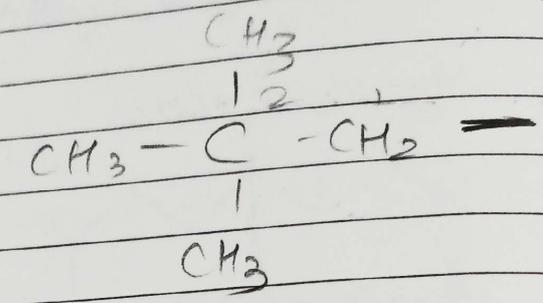
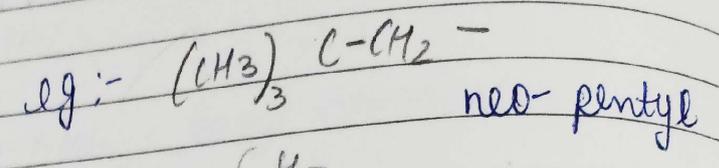
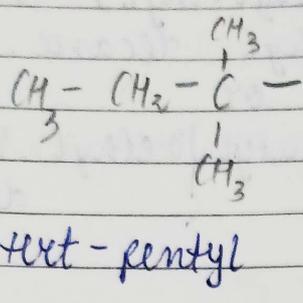
\* Trivial naming system for complex substituent  
or  
Common



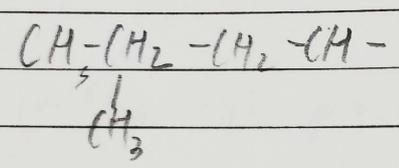
ex:-



eg:-

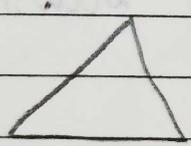


iso-hexyl



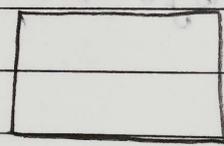
\* Nomenclature of cyclic compound :-

ex)



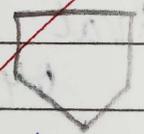
cyclopropane

ex)



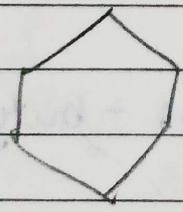
cyclobutane

ex)



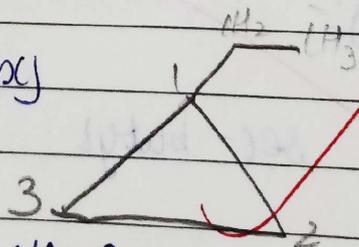
cyclopentane

ex)



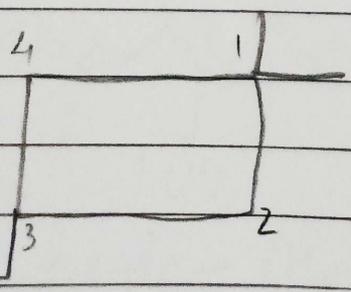
cyclohexane

ex)



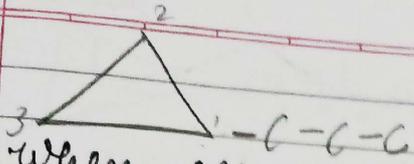
1-ethyl cyclopropane

ex)



3-ethyl-1,1-dimethyl cyclobutane

ex)

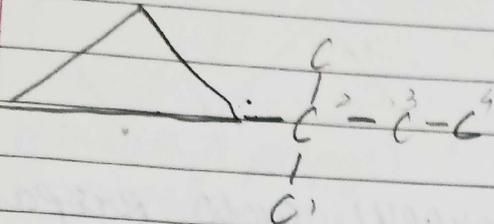


1-propyl cyclo propane ✓

1-cyclopropyl propane ✗

→ when open chain & closed chain have same no. of carbon, then consider cyclic chain as a main chain (long chain).

ex:



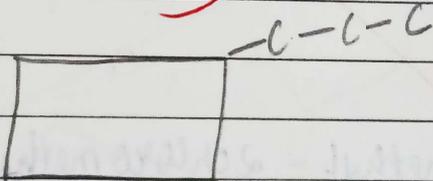
2-cyclopropyl-2-methyl butane

⇒ when open chain & closed chain both are present then, give priority to more no. of carbon chain

\* Priority Order:- (Cyclic vs open chain)

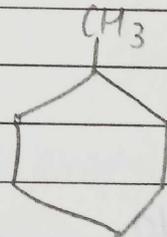
Functional group > = > ≡ > No. of carbon group

ex:-



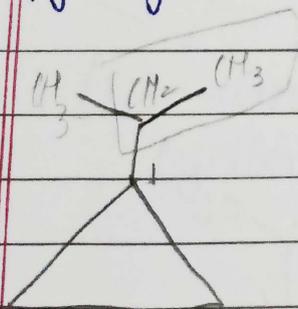
1-propyl-cyclo-butane

ex:-



1-methyl cyclo hexane

ex:-

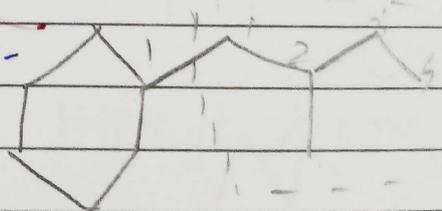


1-(1-methyl ethyl) cyclo propane

or

1-(isopropyl) cyclo propane

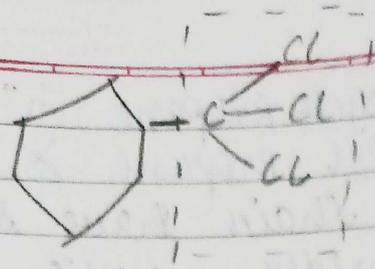
ex:-



1-(2-Methyl butyl) cyclohexane

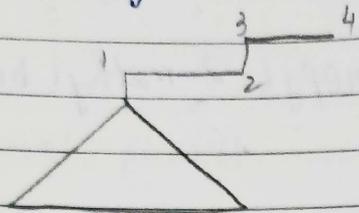
1-(isopentyl) cyclohexane

ex:-



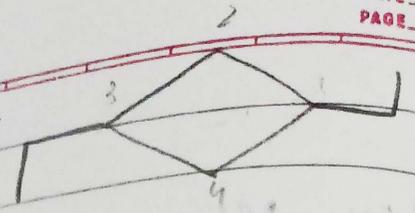
→ 1-(1,1,1-trichloromethyl)  
cyclohexane

ex:-



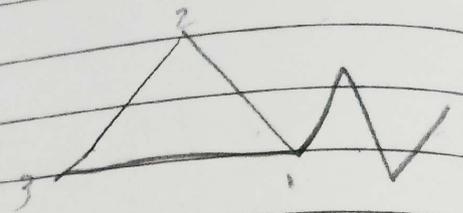
1-cyclopropyl butane

ex:-



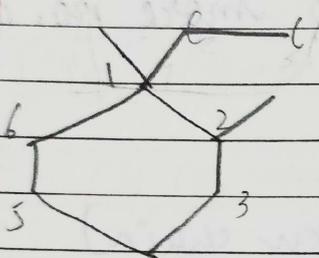
1,3-diethyl cyclobutane

ex:-



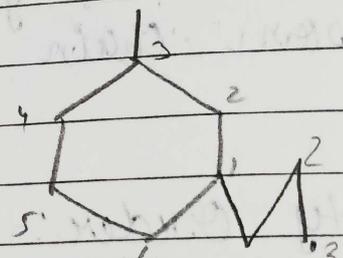
1-propyl cyclo propane

ex:-



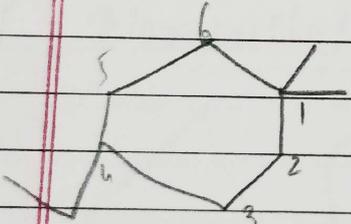
1-ethyl-1,2-dimethyl cyclohexane

ex:-



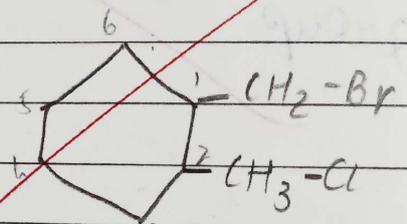
1-methyl-3-propyl cyclohexane

ex:-



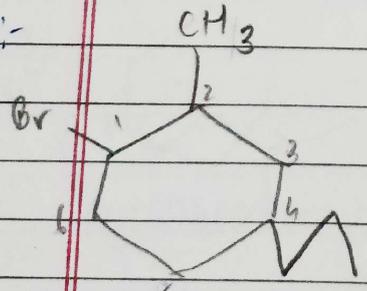
4-ethyl-1,1-dimethyl cyclohexane

ex:-



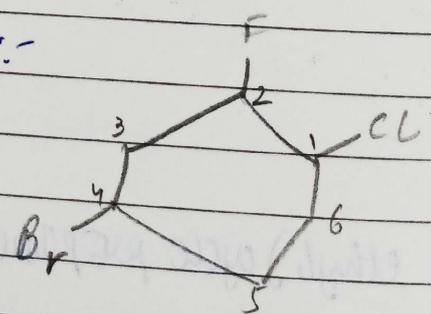
1-Bromomethyl-2-chloromethyl cyclohexane.

ex:-



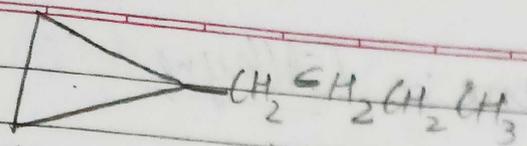
1-bromo-4-methyl  
2-propyl cyclohexane

ex:-



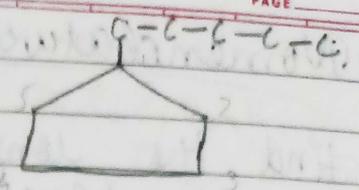
4-bromo 1-chloro 2-fluoro cyclohexane

sol:-



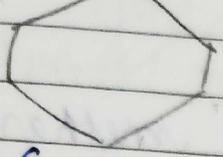
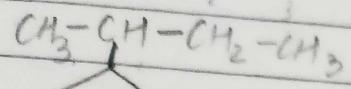
1-cyclopropyl butane

ex:-



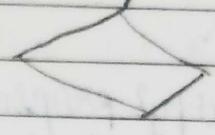
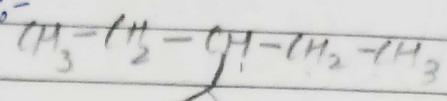
1-pentyl cyclo pentane

ex:-



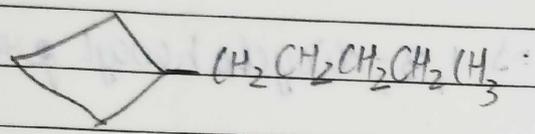
→ 1-(1-methyl propyl)  
cyclohexane

ex:-



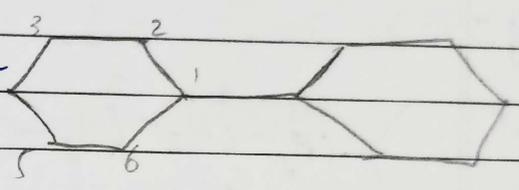
3-cyclo butyl pentane

sol:-



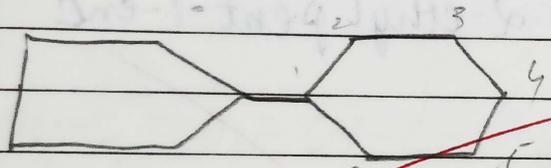
1-cydo butyl pentane

ex:-



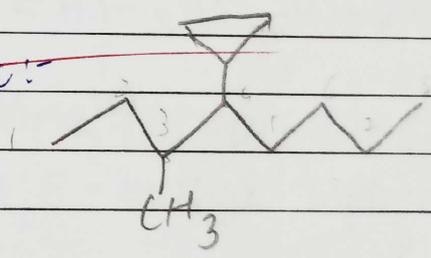
1-cyclo hexyl heptane

ex:-



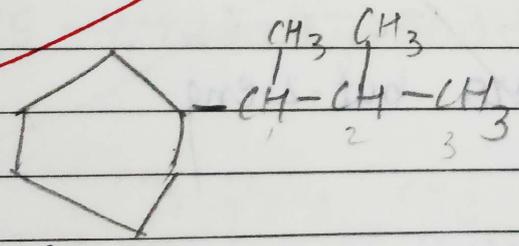
→ 1-cyclo pentyl cyclo hexane

ex:-



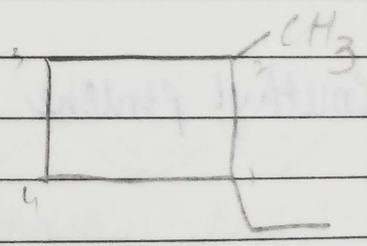
4-cyclo propyl 3-methyl octane

ex:-



1-(1,2-dimethyl propyl)  
cyclohexane

ex:-



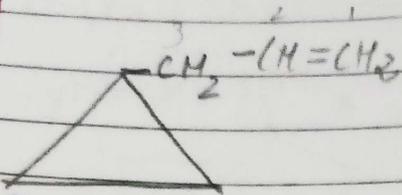
1-ethyl -2-methyl cyclo  
butane

~~\*~~

Nomenclature :- Alkene :- / Alkyne :-

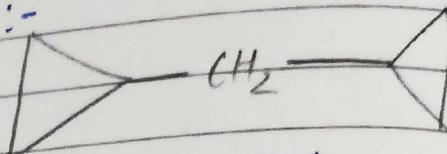
Rule:- Find the longest chain starting from double bond or triple bond.

ex:-



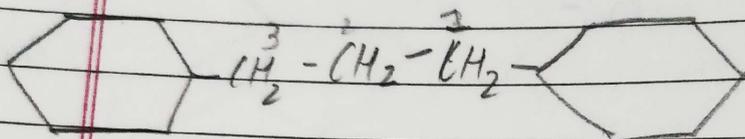
→ 3-cyclopropyl propene

ex:-



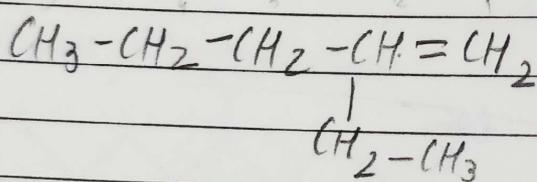
1,1-dicyclopropyl methane

eg:-



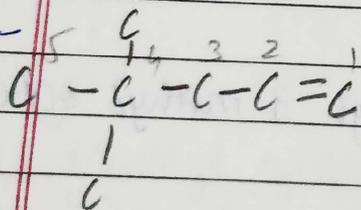
→ 1,3-dicyclohexyl propane

ex:-



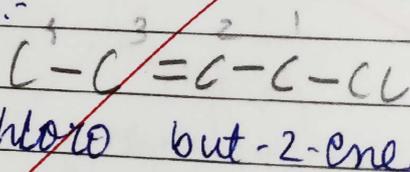
→ 2-ethyl pent-1-ene

ex:-



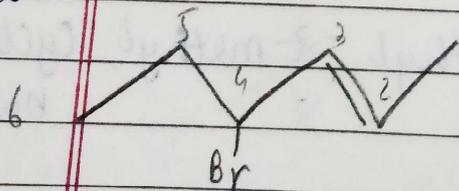
4,4 dimethyl pentene

ex:-



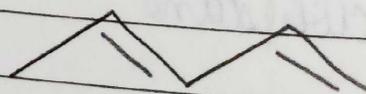
1-chloro but-2-ene

ex:-



4-bromo hex-4-ene

ex:-

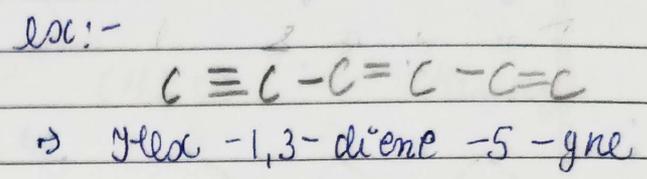
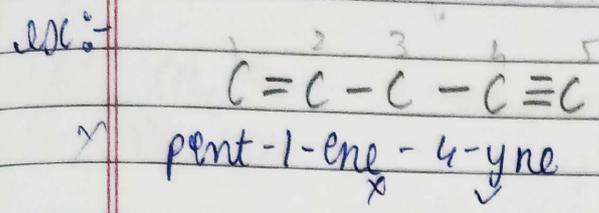
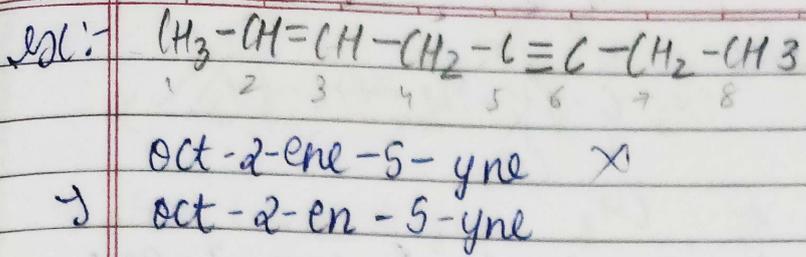


Pent-1,3-diene

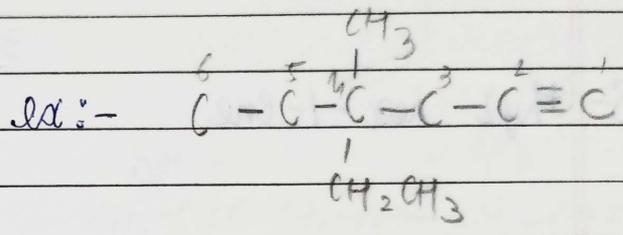
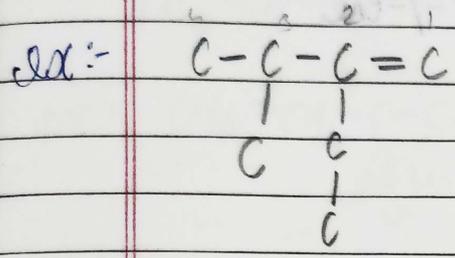
Select the chain in which = bond could get lowest no.

Rule

If there are letters  
a, e, i, o, u, y,  
then ene - 5 - yne

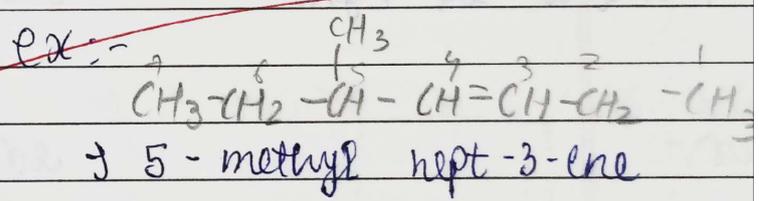
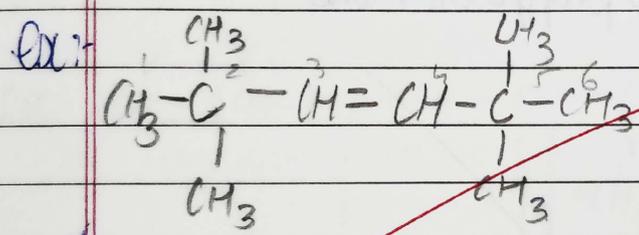


∴ pent-1-en-4-yne

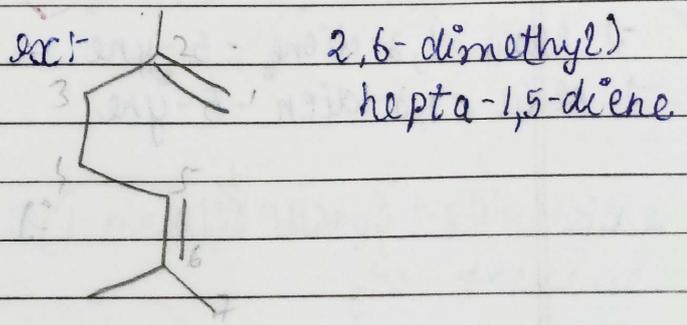
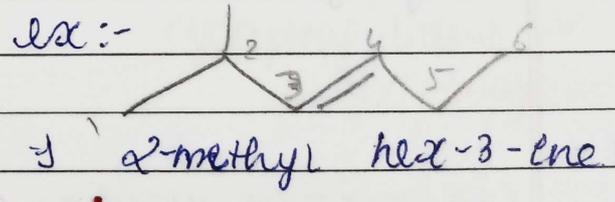
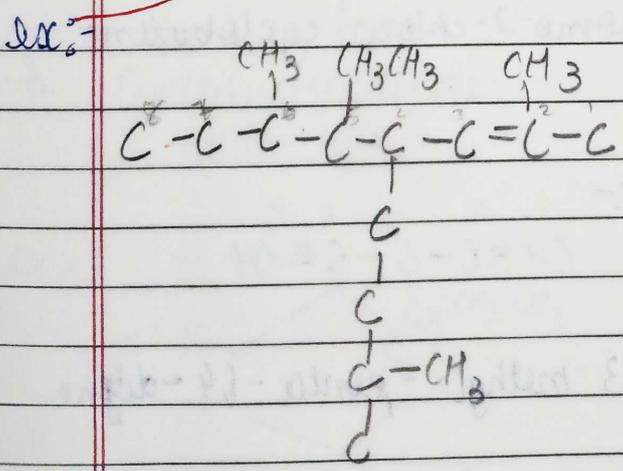


→ 4-ethyl-4-methyl hex-1-yne

→ 2-ethyl 3-methyl but-1-ene

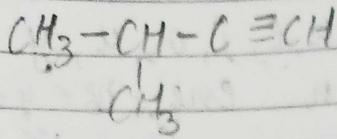


→ 2,2,5,5-tetramethyl hex-3-ene



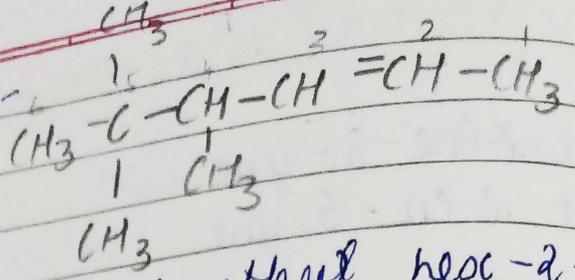
→ 5-ethyl-2,6-dimethyl  
 -4-(3-methylbutyl) oct-2-ene

ex:-



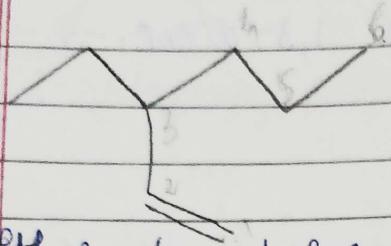
→ 3-methyl but-1-yne

ex:-



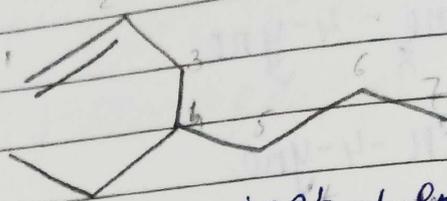
→ 4,5,5-trimethyl hept-2-ene

ex:-



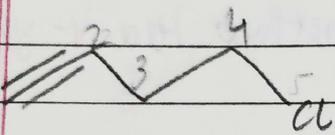
→ 3-ethyl hept-1-ene

ex:-



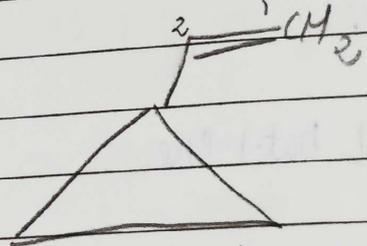
→ 4-ethyl hept-1-ene

ex:-



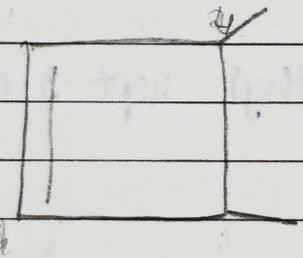
→ 4-chloro but-1-yne

ex:-



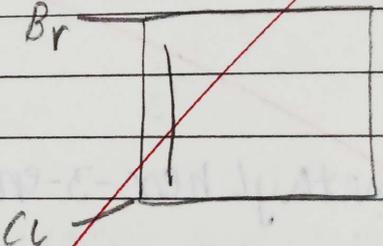
→ 2-cyclopropyl eth-1-ene

ex:-



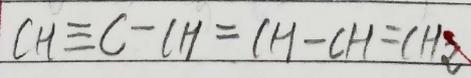
→ 3,4-dimethyl cyclobut-1-ene

ex:-



→ 1-bromo-2-chloro cyclobutene

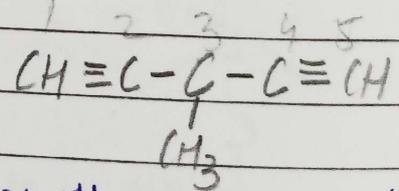
ex:-



→ hexa-1,3-diene-5-yne

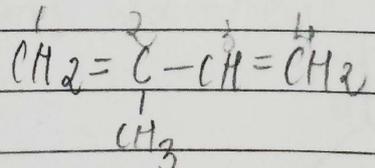
→ hexa-1,3-dien-5-yne

ex:-

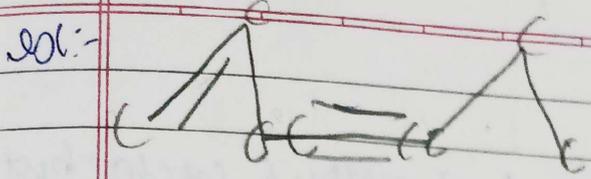


→ 3-methyl-penta-1,4-diene

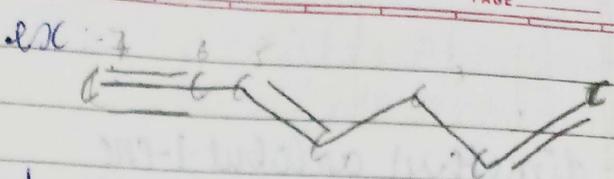
ex:-



→ 2-methyl buta-1,3-diene



→ Oct-1-ene-4-yne



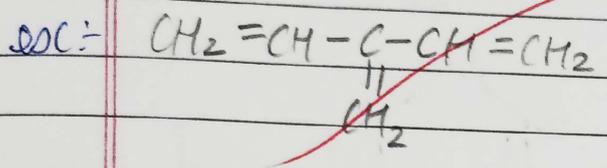
→ Hepta-1,4-diene-6-yne



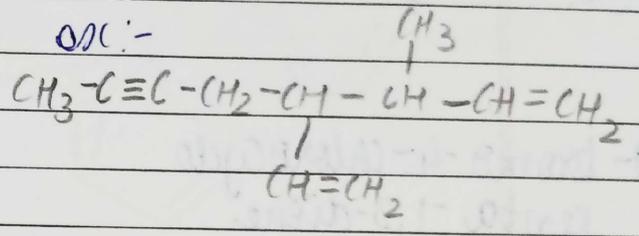
$\text{CH}_2 =$  → methylene / methylenidene  
 $\text{CH}_2 = \text{CH} -$  → vinyl (common)  
 or ethenyl (IUPAC)

$\text{CH} \equiv \text{C}$  → ethynyl

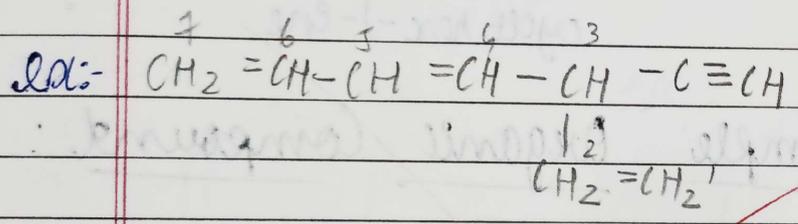
$\text{CH}_3 - \text{CH} =$  → ethylidene



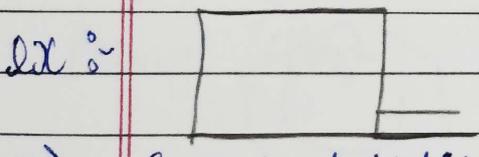
→ 3-methylene-penta-1,4-diene



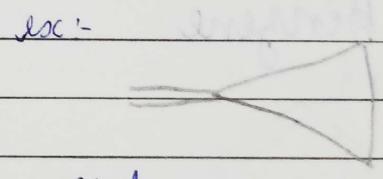
→ 4-ethenyl-3-methyl-oct-1-ene-6-yne



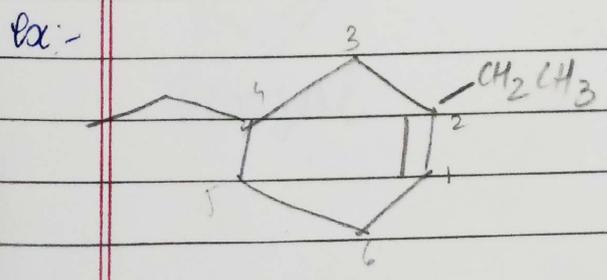
→ 3-ethynyl-hepta-1,4,6-triene



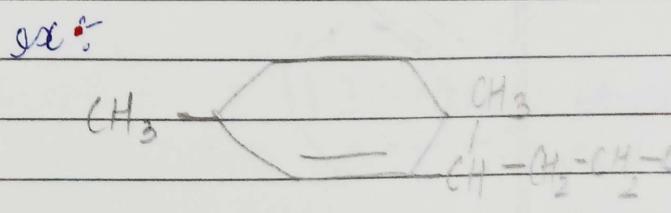
→ Cyclobutylidene or cyclobutylene



cyclopropylidene or cyclopropylene

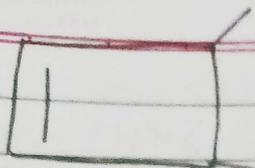


→ 2,4-ethylhex-1-ene



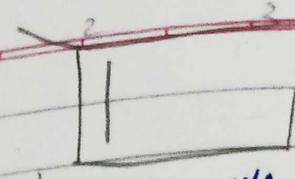
3-(1-methylbutyl)-6-methylheptene

ex:-



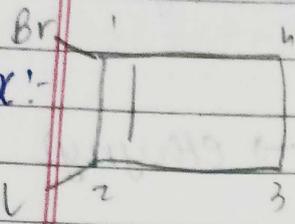
3,4-dimethyl cyclobut-1-ene

ex:-



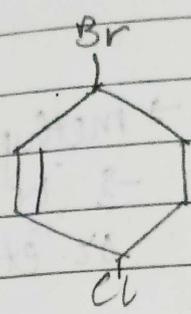
3-ethyl-2-methyl cyclo-but-1-ene

ex:-



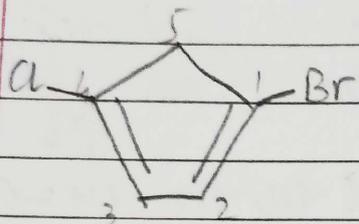
1-bromo-2-chloro cyclo but-1-ene

ex:-



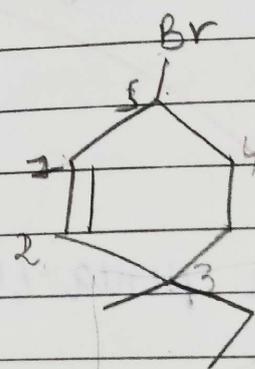
3-bromo-5-chloro cyclo but-1-ene

ex:-



1-bromo-4-chloro cyclo penta-1,3-diene

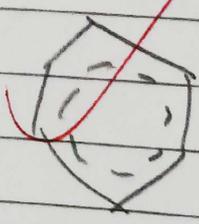
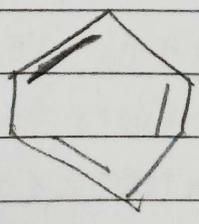
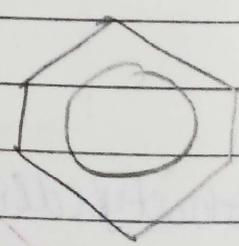
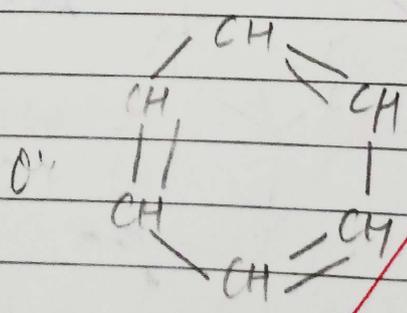
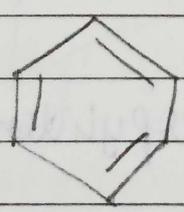
ex:-



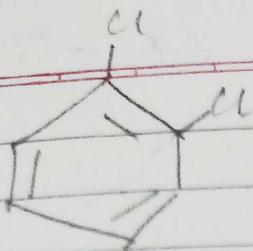
6-bromo-3-ethyl-3-methyl cyclo hex-1-ene

# \* Nomenclature of Simple Organic Compound:

## • Benzene



eg:-

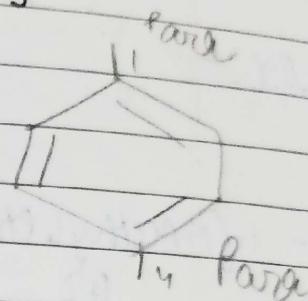
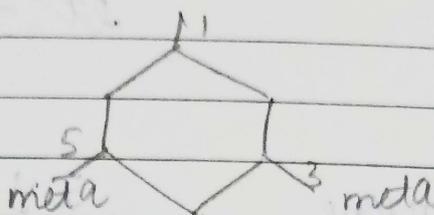
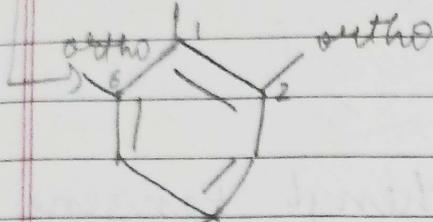


IUPAC :- 1,2-dichlorobenzene  
ortho-dichlorobenzene

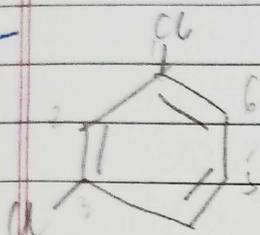
In

Common :-

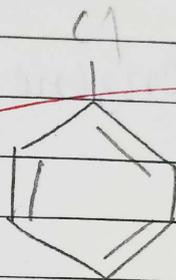
1,2 or 1,6 → ortho position (o-)  
1,3 or 1,5 → meta (m-)  
1,4 → para (p-)



ex:-



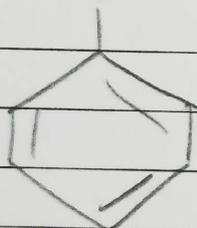
ex:-



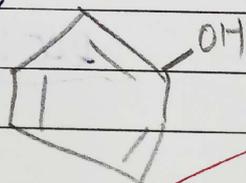
IUPAC :- 1,3-dichlorobenzene  
C :- m-dichlorobenzene

C :- p-dichlorobenzene

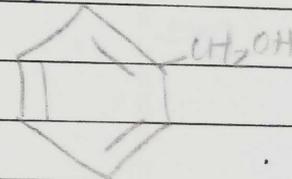
ex:-



ex:-



ex:-

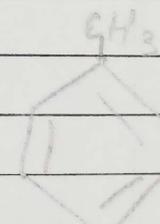
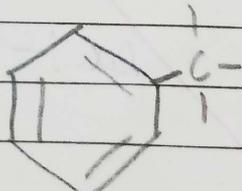
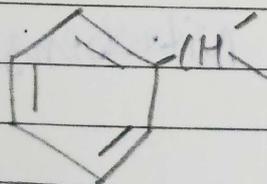


Phenyl (C<sub>6</sub>H<sub>5</sub>)

phenol

Benzyl

ex:-



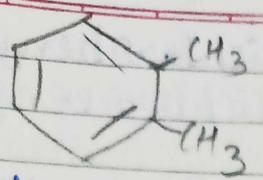
Benzal

Benzo

I :- Methyl benzene

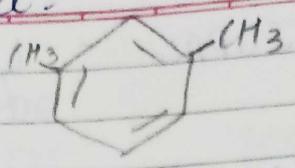
C :- Toluene

ex:-



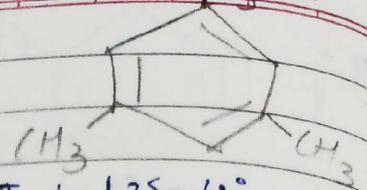
I :- 1,2-dimethyl benzene

ex:-



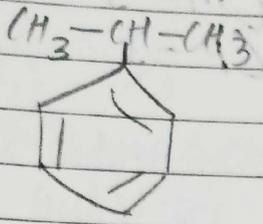
(m-xylene)

ex:-



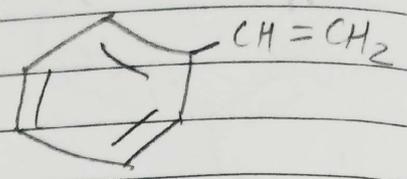
I :- 1,3,5-trimethyl benzene  
C :- Mesitylene

ex:-



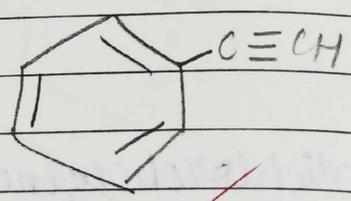
I :- 1-(1-methylethyl) benzene  
or  
Isopropyl benzene  
or  
Cumene

ex:-



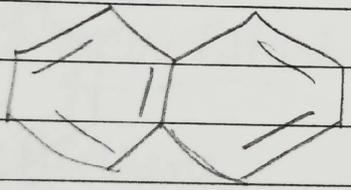
I :- ethenyl benzene  
C :- styrene

ex:-



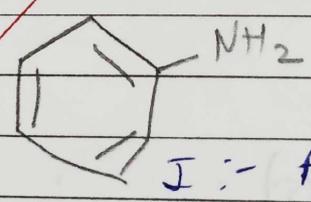
I :- ethynyl benzene  
C :- phenyl Acetylene

ex:-



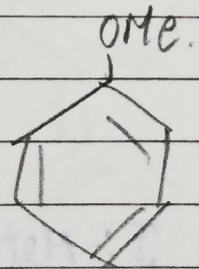
I :- Naphthalene  
(4n+2) π e<sup>-</sup>

ex:-



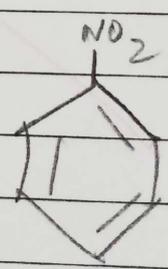
I :- Aniline  
C :- Aniline

ex:-



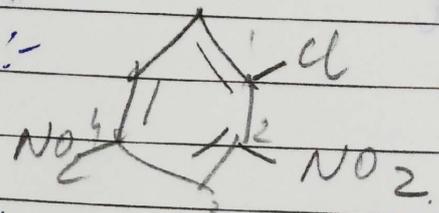
I :- Methoxy Benzene  
C :- Anisole

ex:-

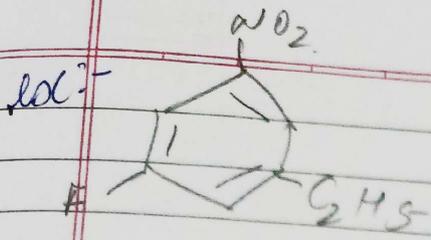


Nitrobenzene

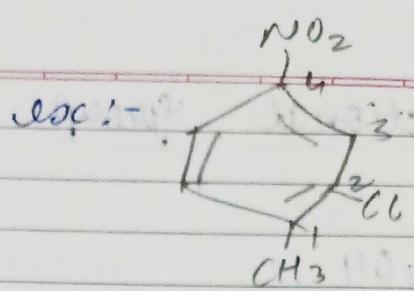
ex:-



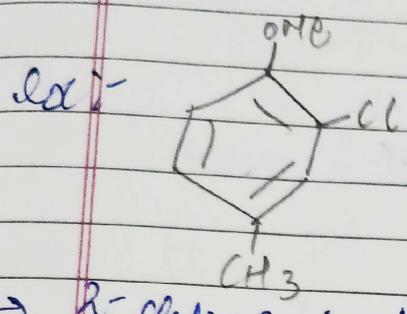
1-chloro - 2,4 - diNitrobenzene



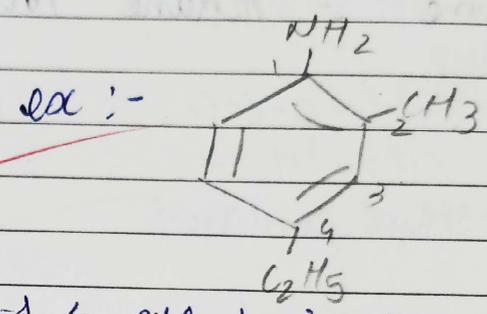
1-ethyl-4-fluoro-3-nitrobenzene



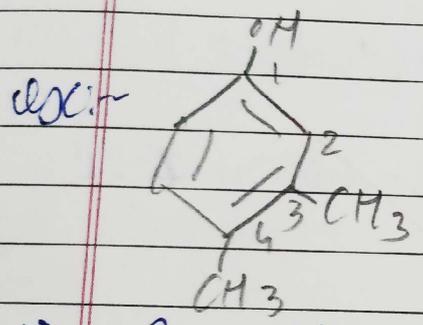
2-chloro-1-methyl-4-nitrobenzene



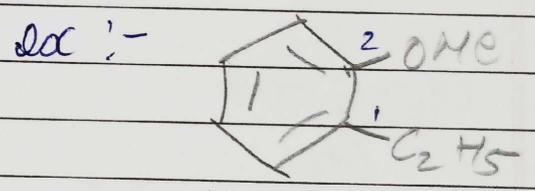
→ 2-chloro-4-methyl anisole



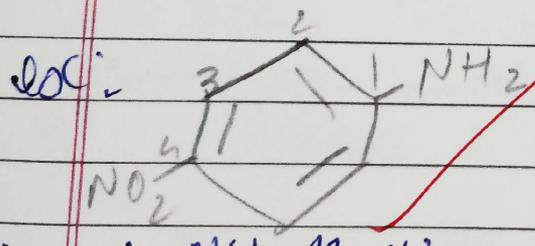
→ 4-ethyl-2-methyl aniline



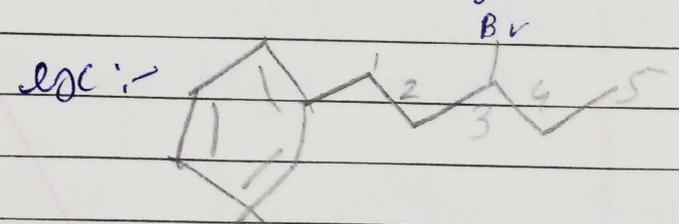
→ 3,4-dimethyl phenol



1-ethyl anisole  
or  
1-ethyl methoxy benzene

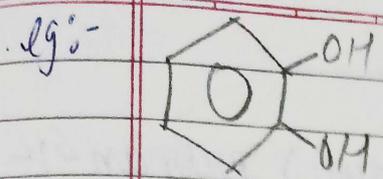


→ 4-nitro aniline

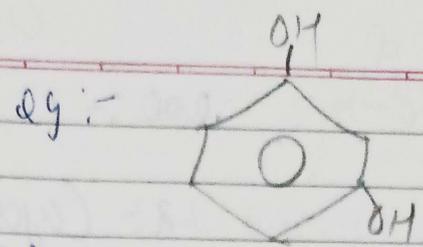


→ 2,3-dibromo-1-phenyl pentane

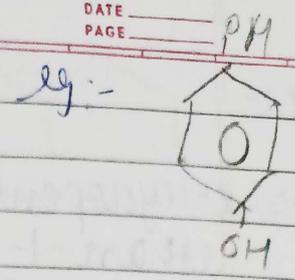




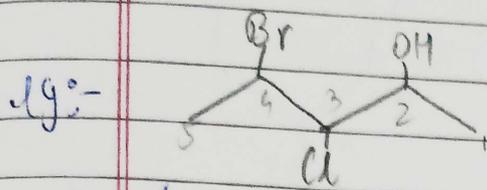
I :- Benzene-1,2-diol  
C :- Catechol



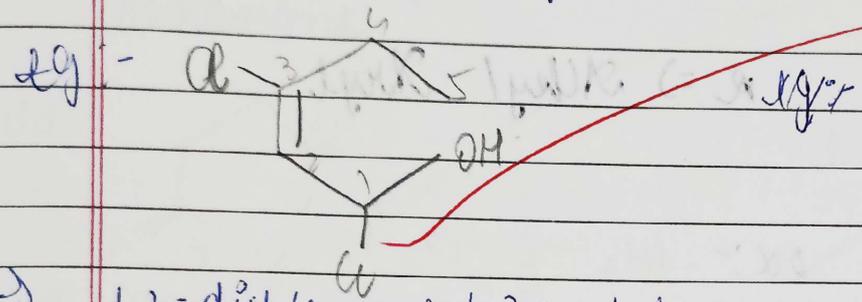
I :- Benzene-1,3-diol  
C :- Resorcinol



I :- Benzene-1,4-diol  
C :- Hydroquinone  
or  
quinone

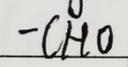


→ 4-bromo-3-chloro-pentan-2-ol

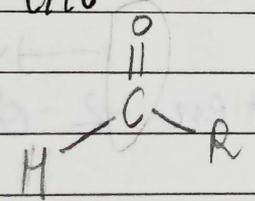
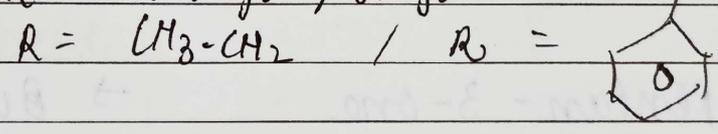


→ 1,3-dichloro-pent-2-ene-1-ol

Q] group :- Aldehyde.

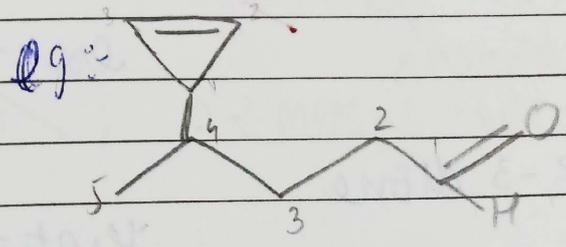
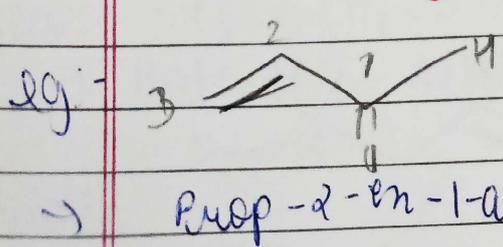
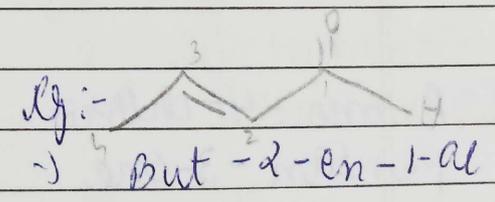
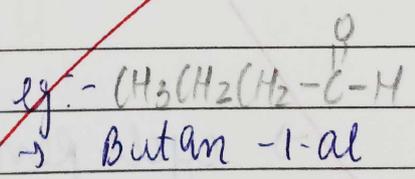
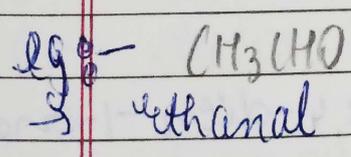


R = Alkyl / Aryl

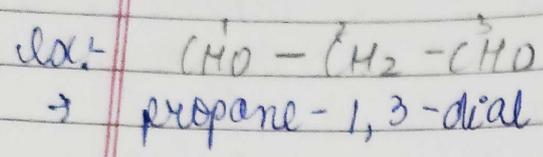
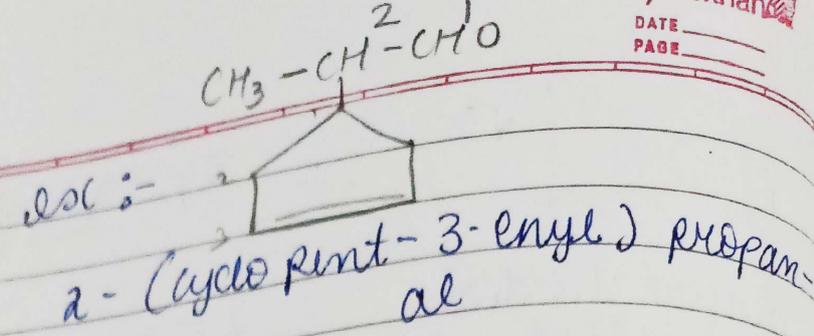
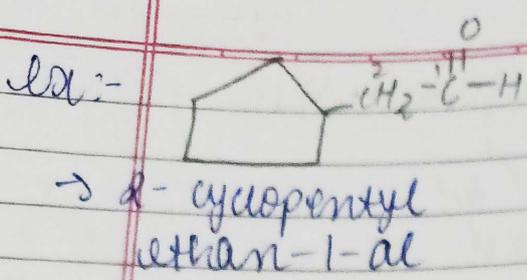


→ Suffix :- 'al'

→ Alkane + al → Alkanal.

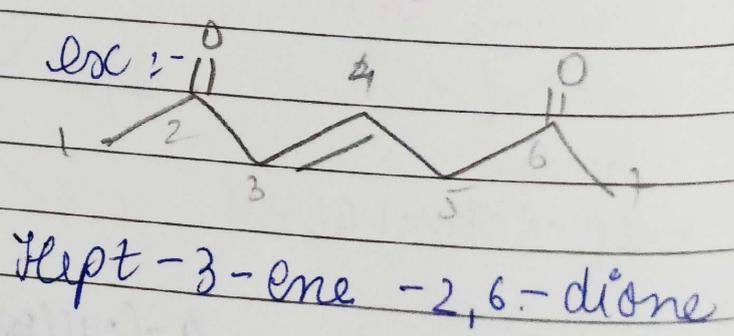
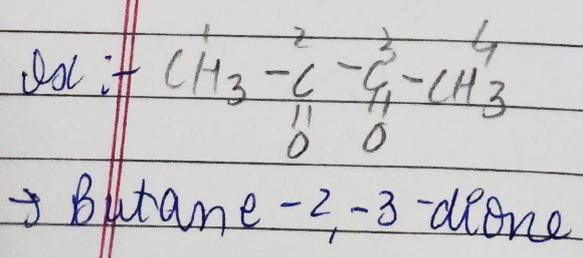
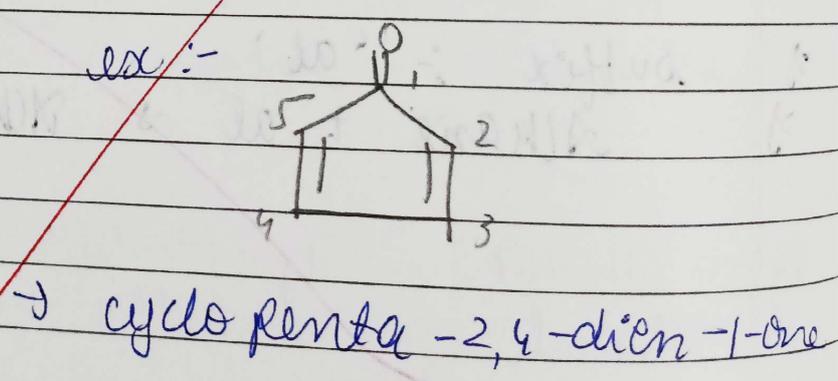
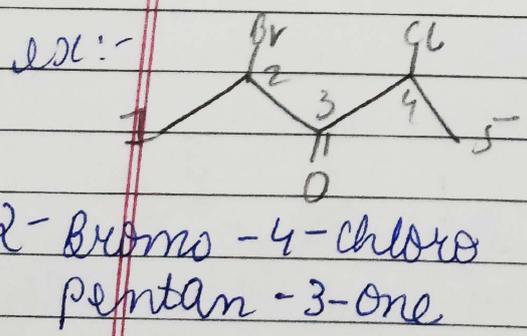
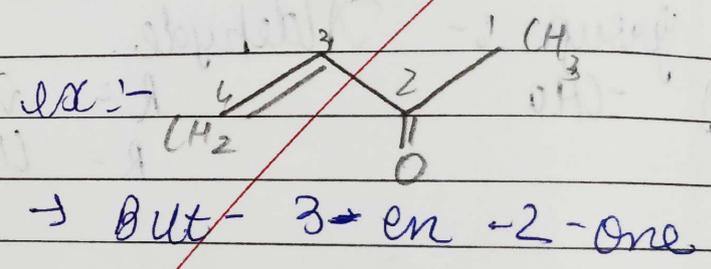
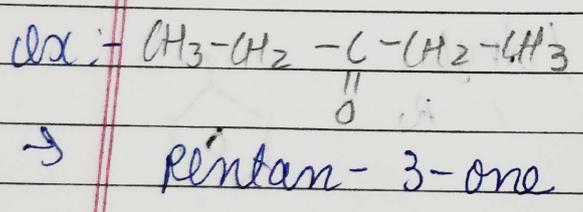
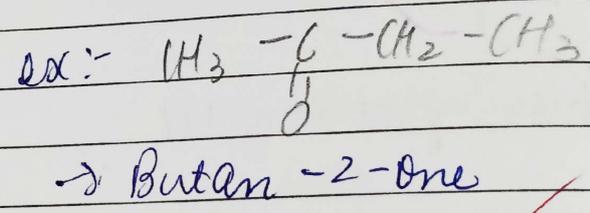
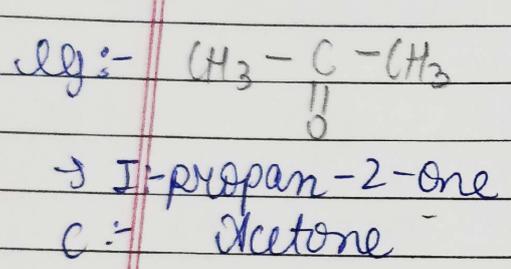


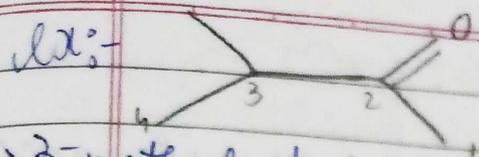
4-(cycloprop-2-enyl)pentan-1-al



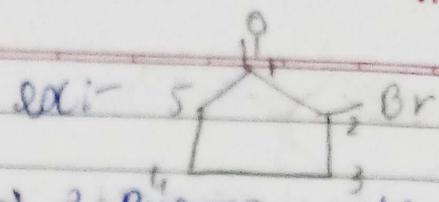
③ Ketone  
 $\rightarrow$  Suffix :- one  
 $\rightarrow$   $R-\overset{\overset{O}{\parallel}}{C}-R'$

R  $\Rightarrow$  Alkyl Aryl

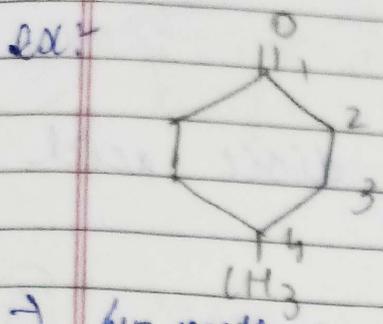




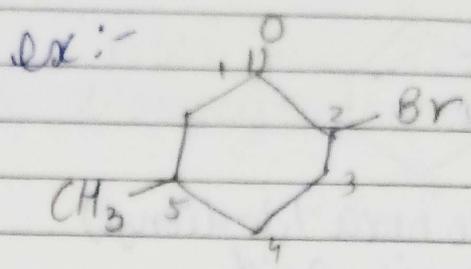
→ 3-methyl butan-2-one



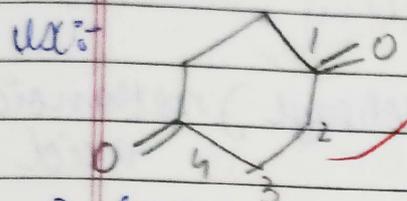
→ 2-bromo cyclopentanone



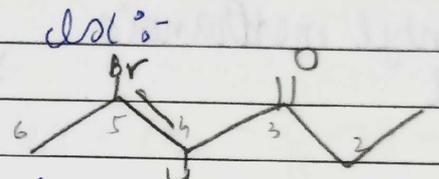
→ 4-methyl cyclohexanone



→ 2-bromo-5-methyl cyclohexanone



→ cyclohexane-1,4-dione



→ 5-bromo-hex-4-en-3-one

(2) Carboxylic Acid :-

→ Suffix :- -oic acid.  
→  $\begin{matrix} \text{O} \\ \parallel \\ \text{C} - \text{OH} \end{matrix}$

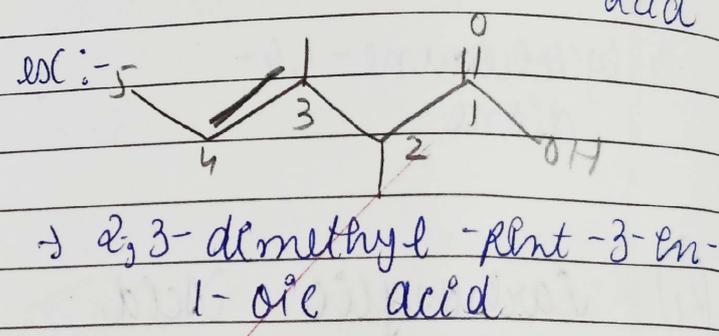
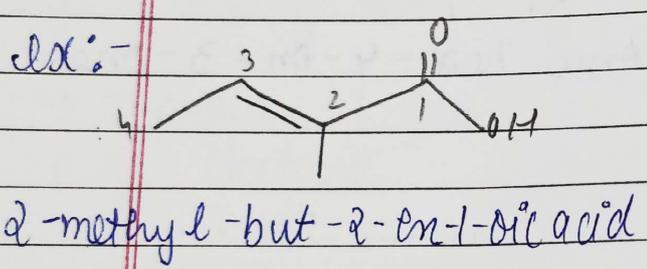
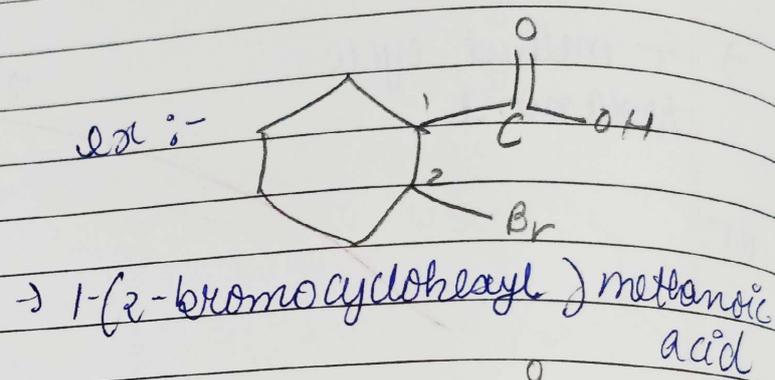
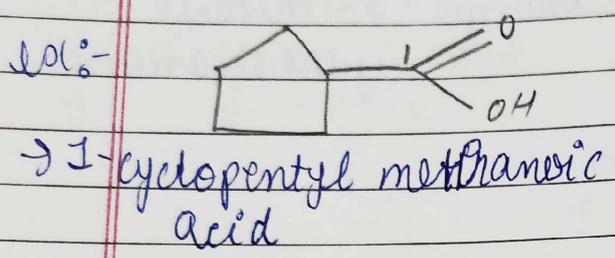
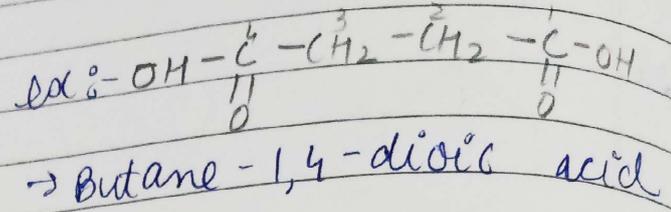
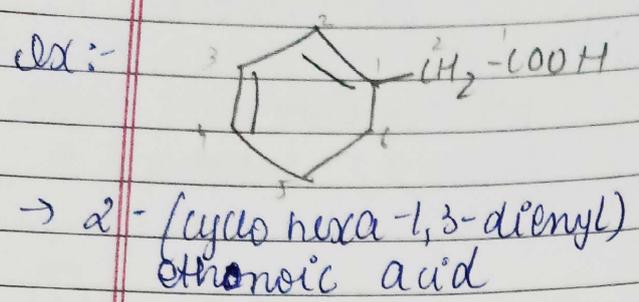
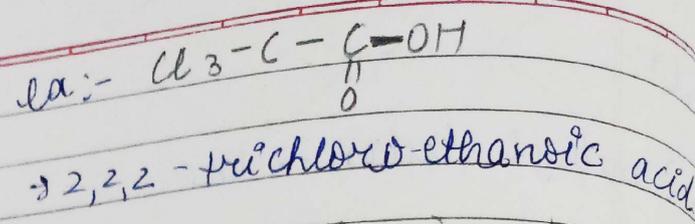
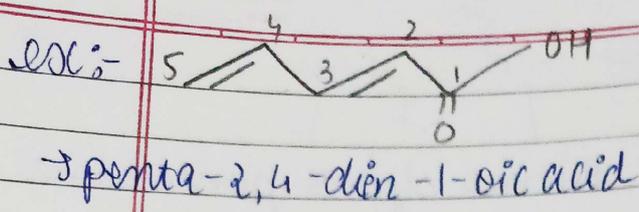
ex:-  $\text{CH}_3\text{COOH}$   
I:- ethanoic acid  
C:- acetic acid

ex:-  $\text{H}-\text{C}(=\text{O})-\text{OH}$   
I:- Methanoic acid  
C:- formic acid

ex:-  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$   
→ Butanoic Acid

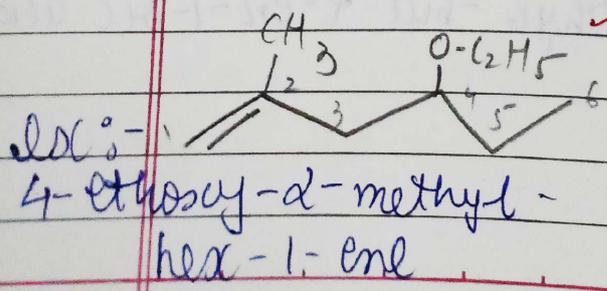
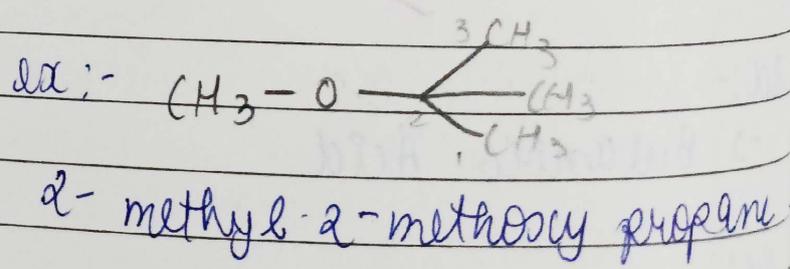
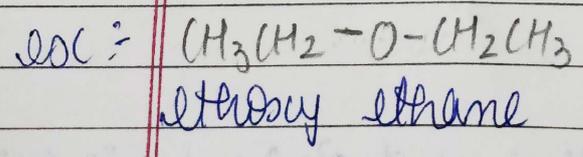
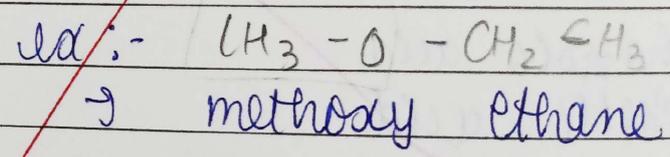
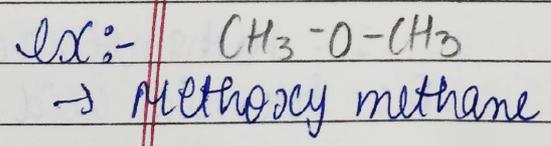
ex:-   
→ 2-methyl-but-2-enoic acid

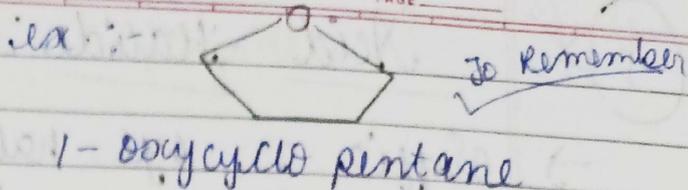
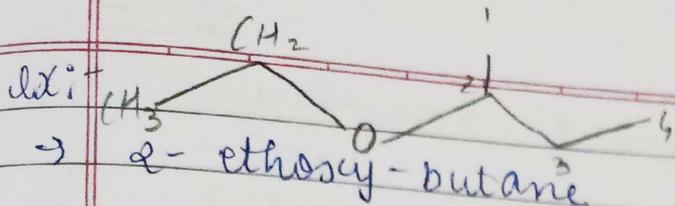
ex:-   
→ 3-(cycloprop-2-enyl)butan-1-oic acid



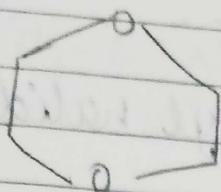
(5) ether  
Prefix :- Alkoxy  
R-O-R'

R = Alkyl / Aryl group





to remember

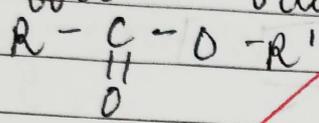


$\rightarrow$  1,4-dioxacyclohexane

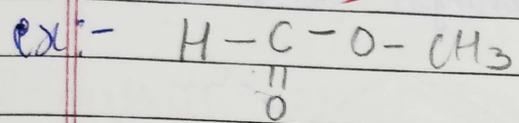
(6)

ester :-

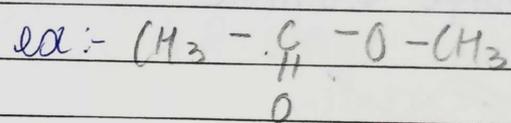
Suffix :- -oate



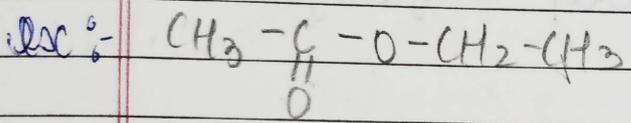
$\Rightarrow$  Alkyl + Alkanoate



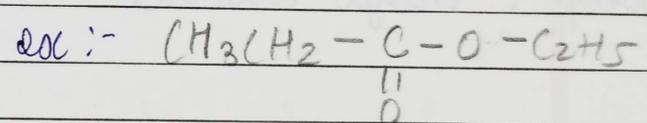
$\rightarrow$  methyl methanoate



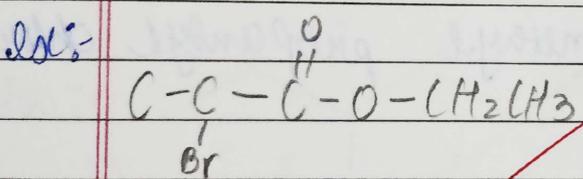
$\rightarrow$  Methyl ethanoate



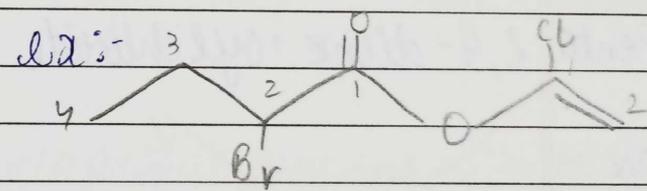
$\rightarrow$  ethyl ethanoate



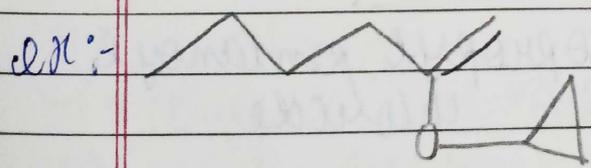
$\rightarrow$  ethyl propanoate



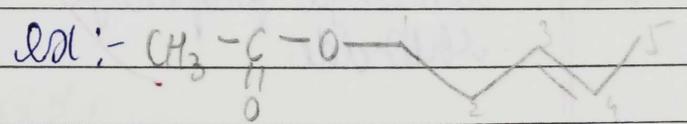
$\rightarrow$  ethyl-2-bromo propanoate



$\rightarrow$  (1-chloro-2-ethyl)butanoate

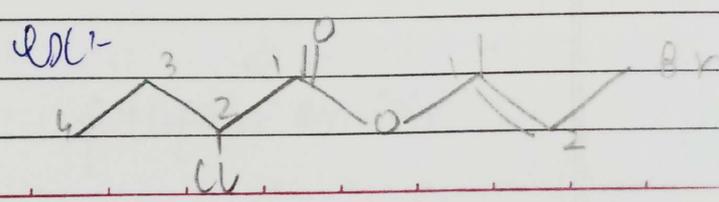


$\rightarrow$  cyclopropyl pentanoate



$\rightarrow$  pent-3-ynyl ethanoate

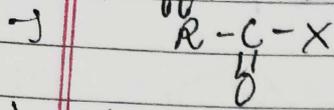
$\rightarrow$  2-bromo-1-methyl ethenyl-2-chloro butanoate



⊕

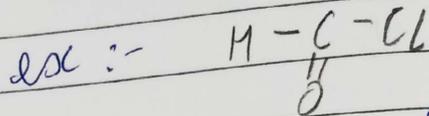
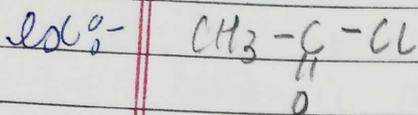
# Acid Halide :-

→ Suffix :- oyl halide



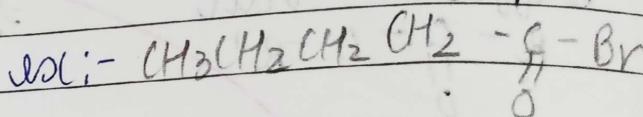
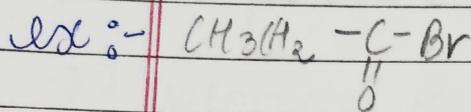
X = F, Cl, Br, I

→ Name format :- Alkane + oyl halide



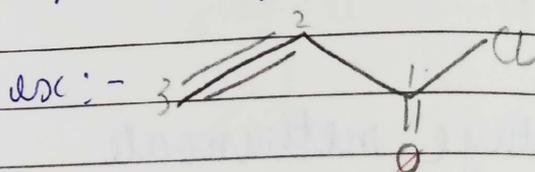
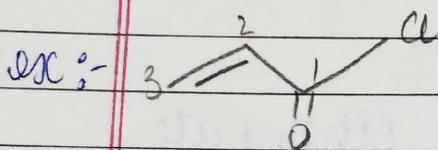
→ ethanoyl chloride

→ Methanoyl chloride



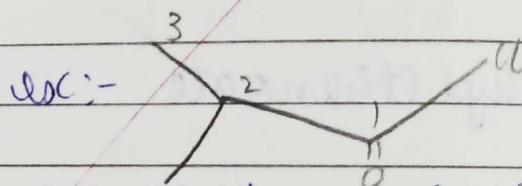
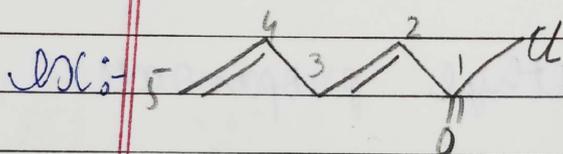
Propanoyl bromide

pentanoyl bromide



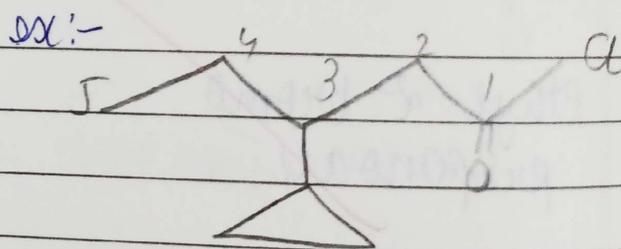
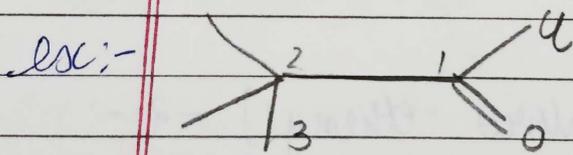
prop-2-enoyl chloride

prop-2-ynoyl chloride



Penta-2,4-dienyl + oyl chloride

2-methyl propionyl chloride



→ 2,2-dimethyl propionyl chloride

3-cyclopropyl pentanoyl chloride

8) Functional group  $\rightarrow$  cyanide.  
 $-C \equiv N$   
 $\rightarrow$  cyanide / nitrile.

ex:  $CH_3-C \equiv N$   
 $\rightarrow$  ethane nitrile

OR  $CH_3-C \equiv N$   
 $\rightarrow$  Methyl cyanide

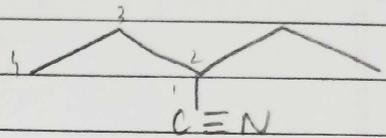
ex:  $CH_3CH_2CN$   
 $\rightarrow$  propane nitrile  
 $\rightarrow$  ethyl cyanide

ex:  $CH_3CH_2CH_2C \equiv N$   
 $\rightarrow$  Butane nitrile or  
 propyl cyanide

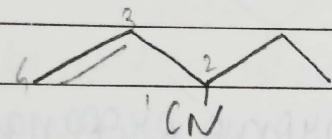
ex:  $CH_3-CH(CH_3)-CN$

$\rightarrow$  2-methyl propane nitrile

OR  
 $\rightarrow$  2-methyl ethyl cyanide

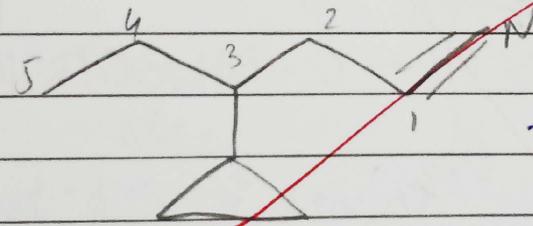
ex: 

$\rightarrow$  2-ethyl butane nitrile

ex: 

$\rightarrow$  2-ethyl-prop-3-ene nitrile

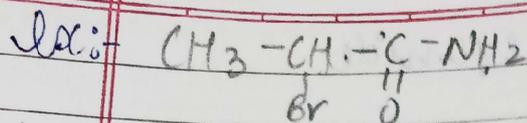
OR  
 $\rightarrow$  2-ethyl-prop-3-enyl cyanide

ex: 

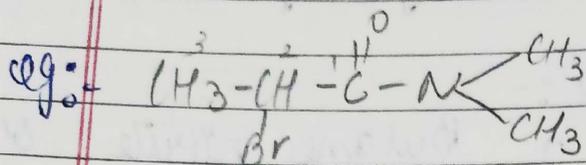
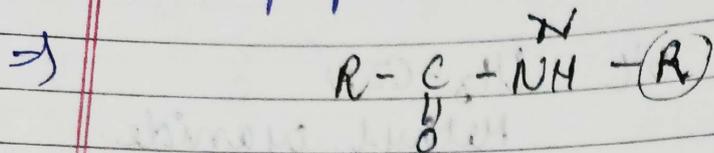
$\rightarrow$  3-cyclopropyl pentane nitrile

9) Amide :-  
 $\rightarrow$  Suffix :- Alkane + amide  
 $\rightarrow$   $R-\overset{\overset{O}{\parallel}}{C}-NH_2$

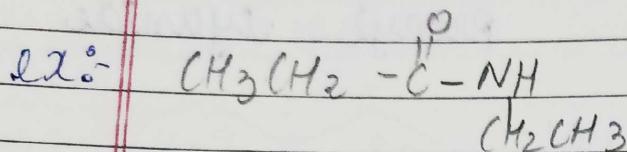
eg:  $CH_3-CH_2-\overset{\overset{O}{\parallel}}{C}-NH_2 \rightarrow$  propan amide



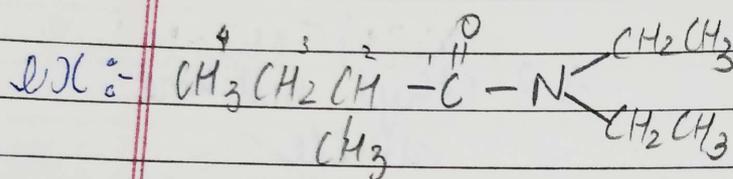
→ 2-bromo propanamide



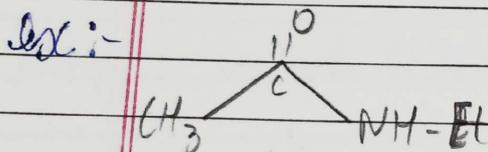
→ 2-bromo, N,N-dimethyl propanamide



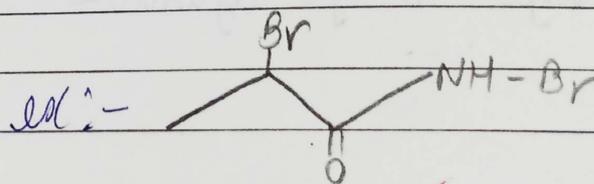
→ N-ethyl propanamide



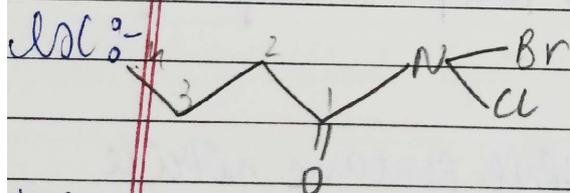
→ 2-methyl-N,N-diethyl butanamide



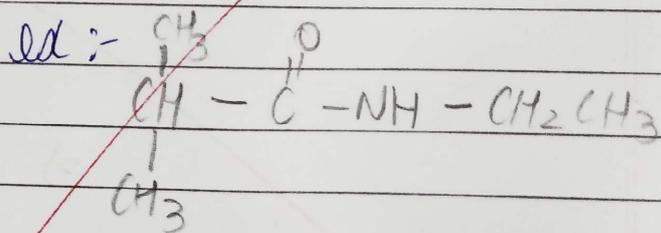
N-ethyl ethanamide



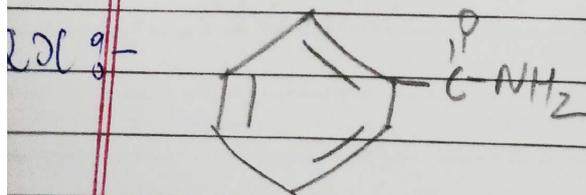
2, N-dibromo propanamide



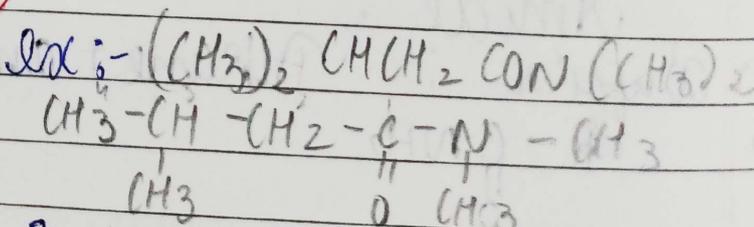
1-bromo, N-chloro butanamide



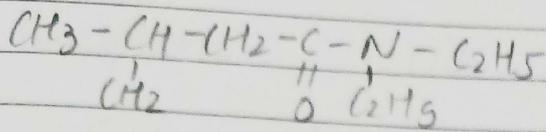
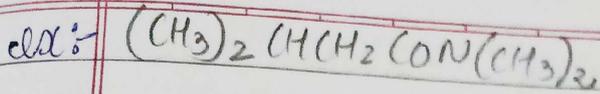
N-ethyl-2-methyl propanamide



Benzamide



→ 3, N,N-dimethyl butanamide



⇒ N,N-diethyl, -3-methylbutanamide.

(10)

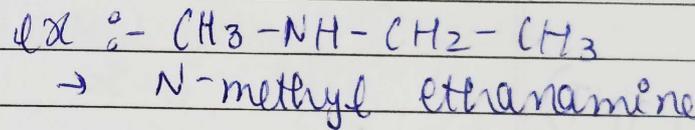
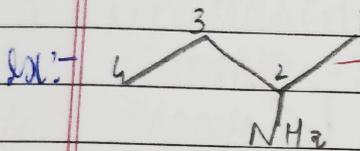
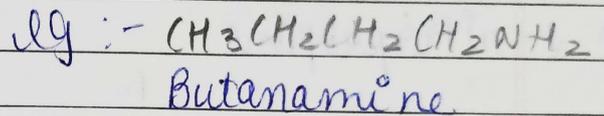
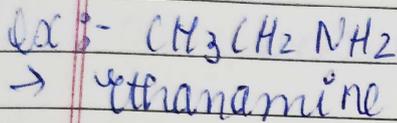
Amines :-

R-NH<sub>2</sub> ⇒ Alkane + amine

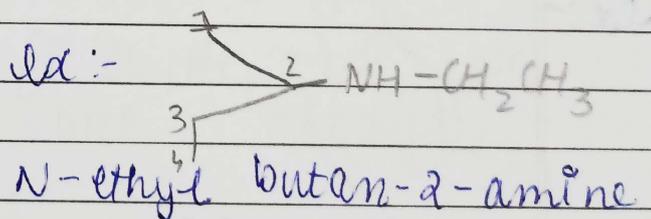
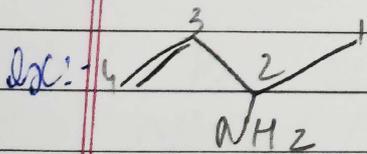
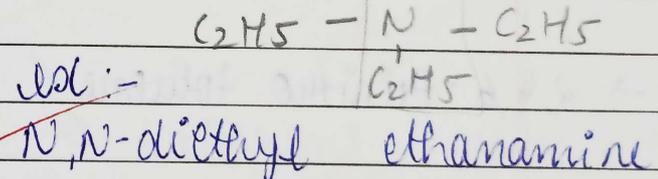
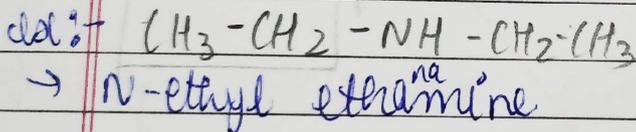
R-NH<sub>2</sub> → 1°

R-NH-R' → 2°

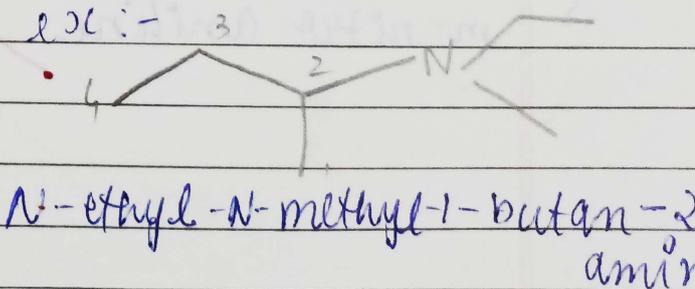
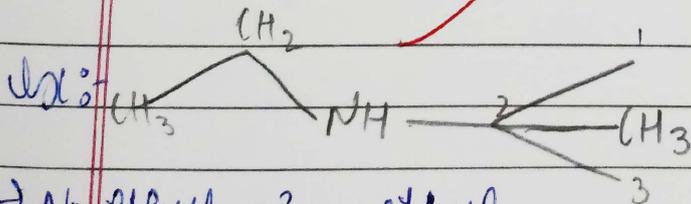
R-N(R')-R'' → 3°



→ Butan-2-amine

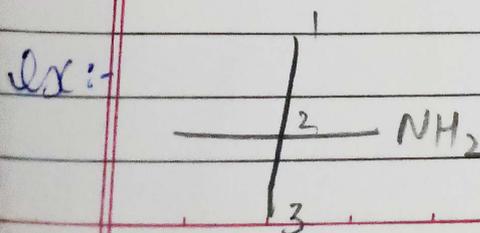


→ But-3-en-2-amine

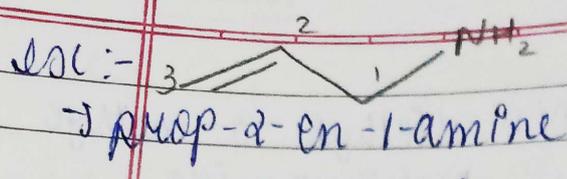


→ N-ethyl-2-methylpropan-2-amine

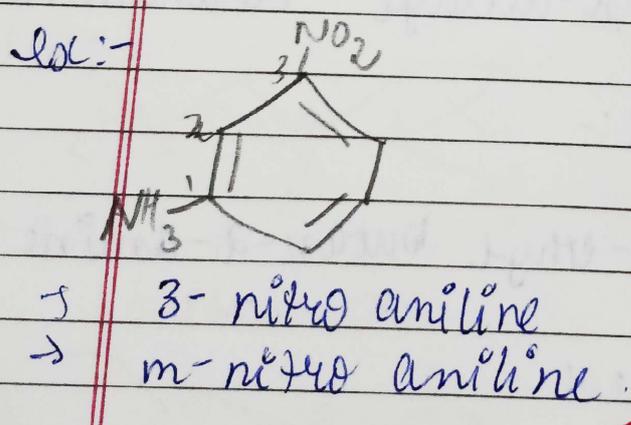
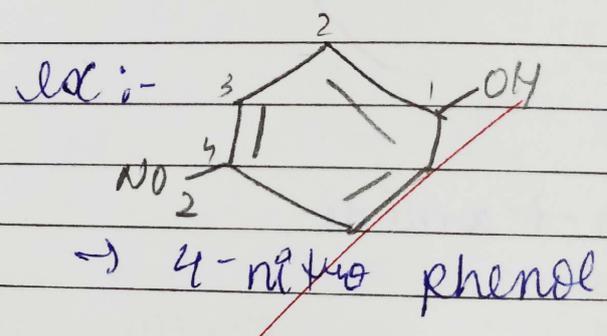
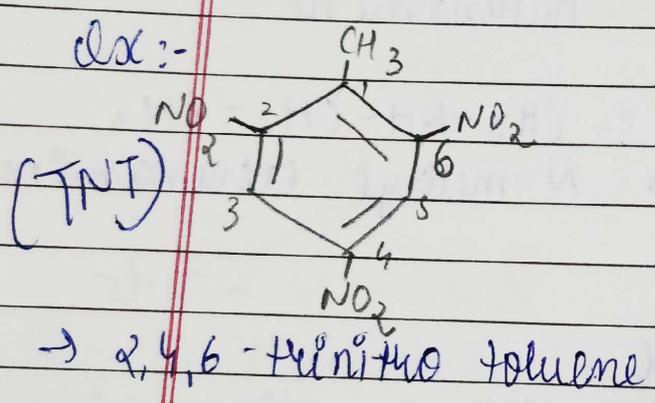
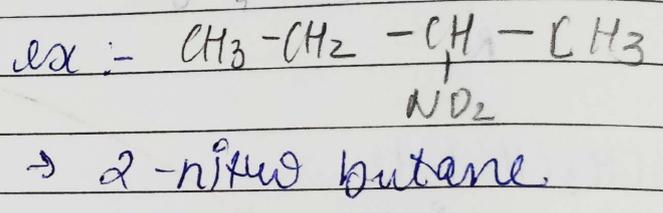
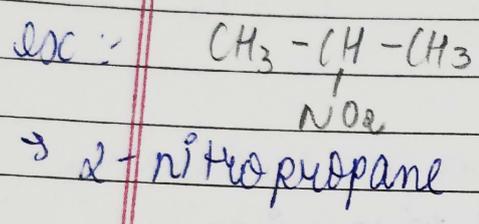
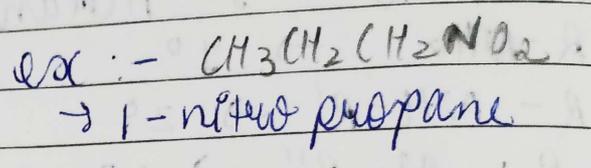
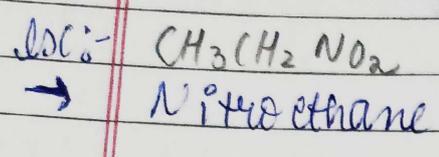
N-ethyl-N-methyl-1-butan-2-amine



⇒ 2-methylpropan-2-amine

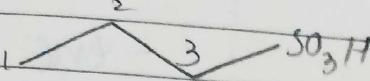


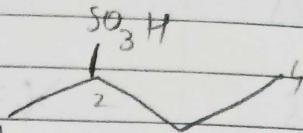
(11) Nitro group :-  
→ NO<sub>2</sub>  
→ Nitro Alkane

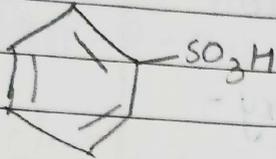


12) Sulphonic group  
 $\rightarrow$   $\text{SO}_3\text{H}$

$\rightarrow$  Sulphonic acid

ex:-   
 $\rightarrow$  Propyl sulphonic acid

ex:-   
 $\rightarrow$  Butyl-2-sulphonic acid

ex:- 

$\rightarrow$  Benzene sulphonic acid

\* Priority order for some functional groups:-

$\rightarrow$  Decreasing order:-

$-\text{COOH}$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{COOR}$  ( $\text{R}$  = alkyl group),  $\text{COCl}$ ,  
 $-\text{CONH}_2$ ,  $-\text{CN}$ ,  $-\text{HC}=\text{O}$ ,  $>\text{C}=\text{O}$ ,  $-\text{OH}$ ,  $-\text{NH}_2$ ,  
 $>\text{C}=\text{C}$ ,  $-\text{C}\equiv\text{C}-$

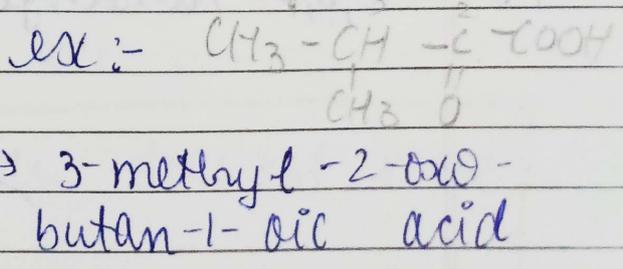
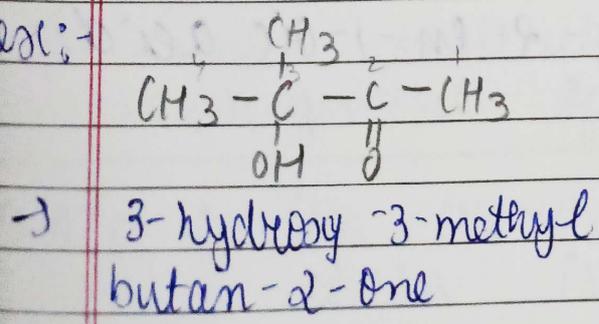
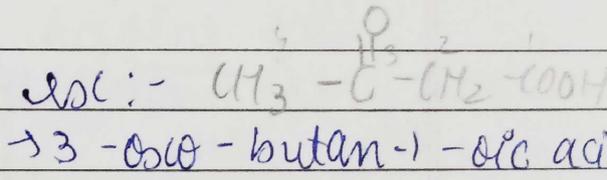
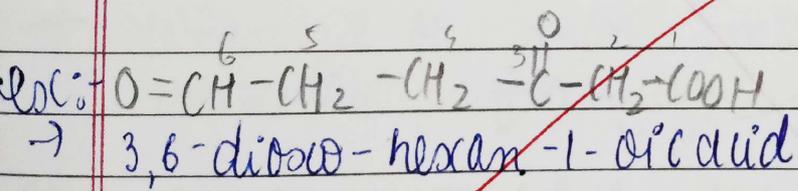
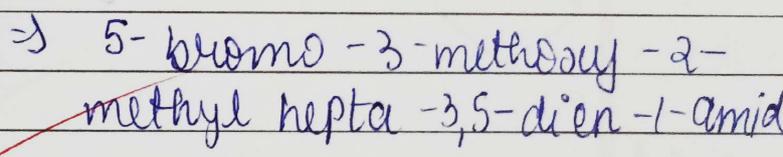
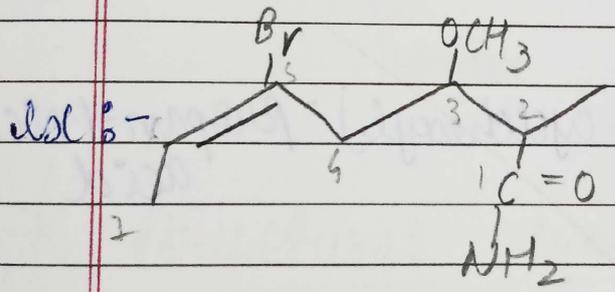
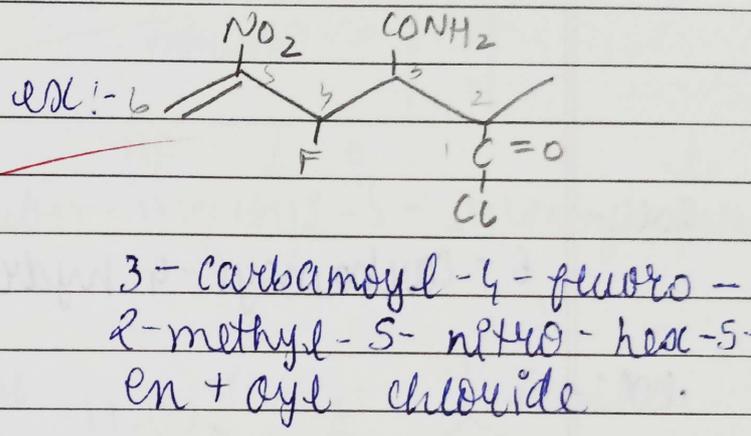
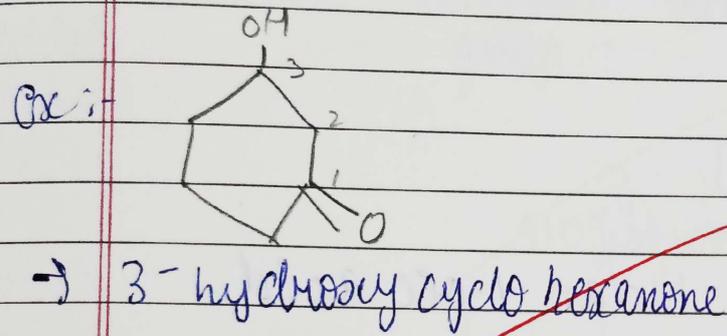
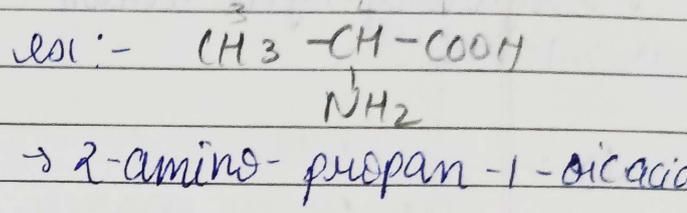
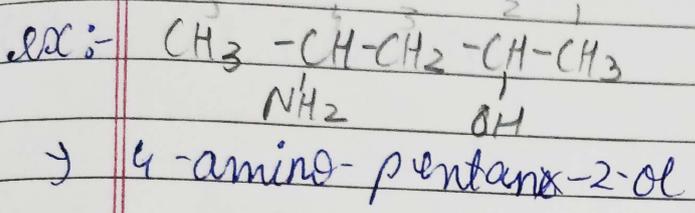
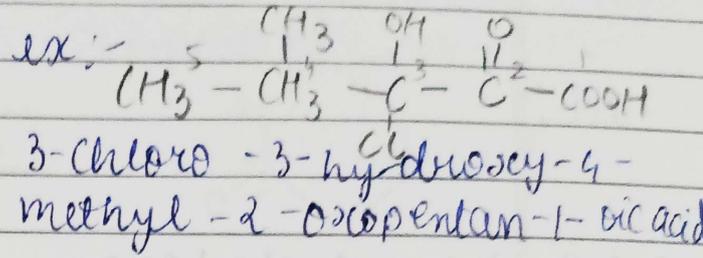
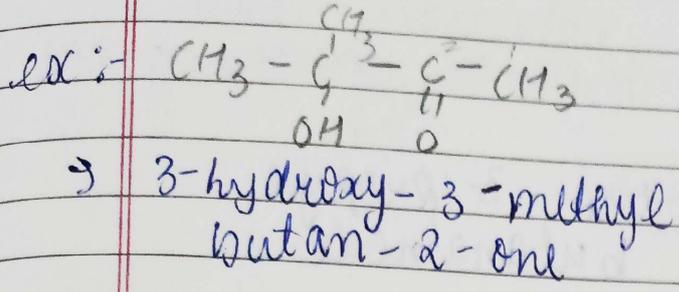
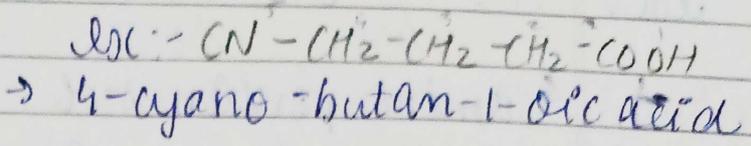
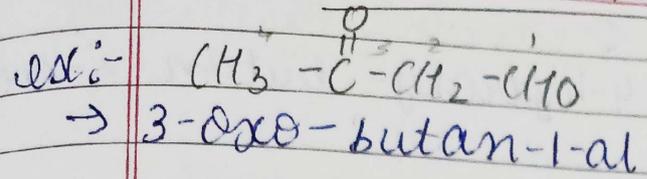
$\rightarrow$  If extended further,  $\rightarrow$  halogens, ether, nitro

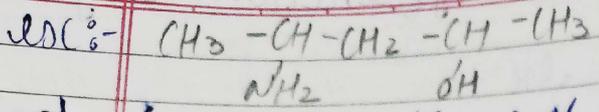
$\rightarrow$   $-\text{R}$ ,  $\text{C}_6\text{H}_5^-$ , halogens ( $\text{F}$ ,  $\text{Cl}$ ,  $\text{Br}$ ,  $\text{I}$ ),  $-\text{NO}_2$ ,  
 alkoxy ( $-\text{OR}$ ) etc. are always  
 prefix substituents.

# Functional group & class of organic compounds.

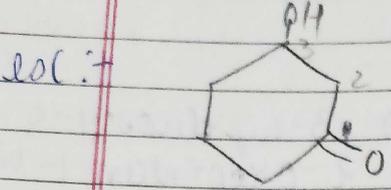
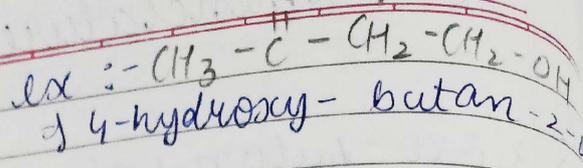
Class of compounds	Structure	Prefix	Suffix
Alkanes	-	-	-ane
Alkenes	$>C=C<$	-	-ene
Halides	$-X$ ( $X=F, Cl, Br, I$ )	halo	-
Alcohols	$-OH$	hydroxy-	-ol
Aldehydes	$-CHO$	formyl or oxo	-al
Ketones	$>C=O$	oxo-	-one
Nitriles	$-C\equiv N$	cyano	nitrile
Ethers	$-R-O-R-$	alkoxy-	-
Carboxylic acids	$-COOH$	carboxy-	-oic acid
Carboxylate ions	$-COO^-$	-	-oate
Esters	$-COOR$	alkoxy carbonyl	-oate
Acyl halides	$-COX$ ( $X=F, Cl, Br, I$ )	halo carbonyl	-oyl halide
Amines	$-NH_2, >NH, >N-$	amino-	-amine
Amides	$-CONH_2, -CONHR, -CONR_2$	-carbamoyl	-amide
Nitro compounds	$-NO_2$	nitro	-
Sulphonic acids	$-SO_3H$	sulpho	sulphonic acid
Alkenes (Benzene (ex))	-	-	-

# \* Nomenclature of Polyfunctional group:

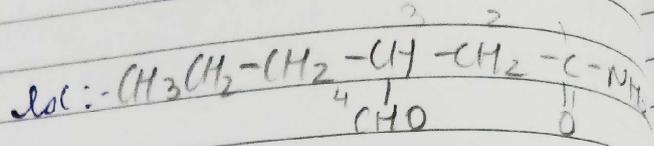




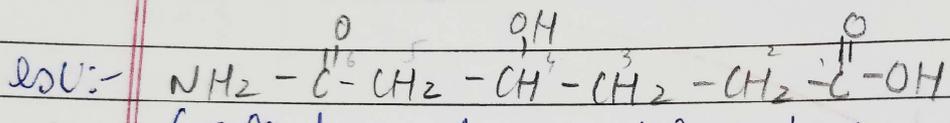
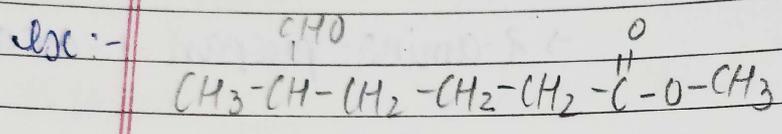
→ 4-amino-pentan-2-ol



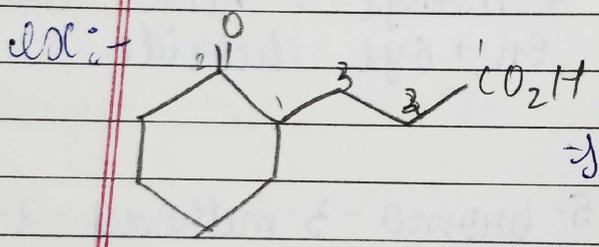
→ 3-hydroxy cyclohexan-1-one



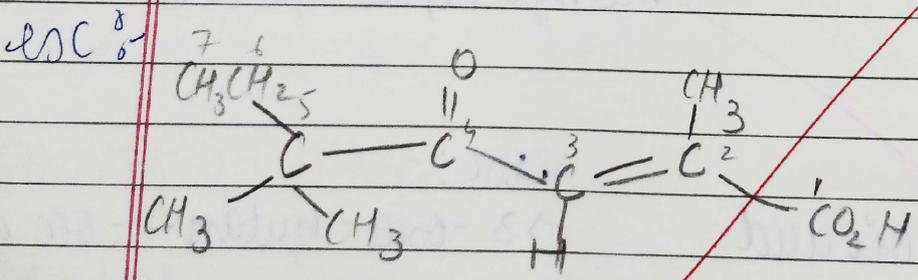
4-oxo-3-propyl butanamide



6-carbamoyl-4-hydroxy-hexan-1-oic acid



→ 3-(2-oxocyclohexyl)-propan-1-oic acid



→ 2,5,5-trimethyl-4-oxo-hept-2-en-1-oic acid

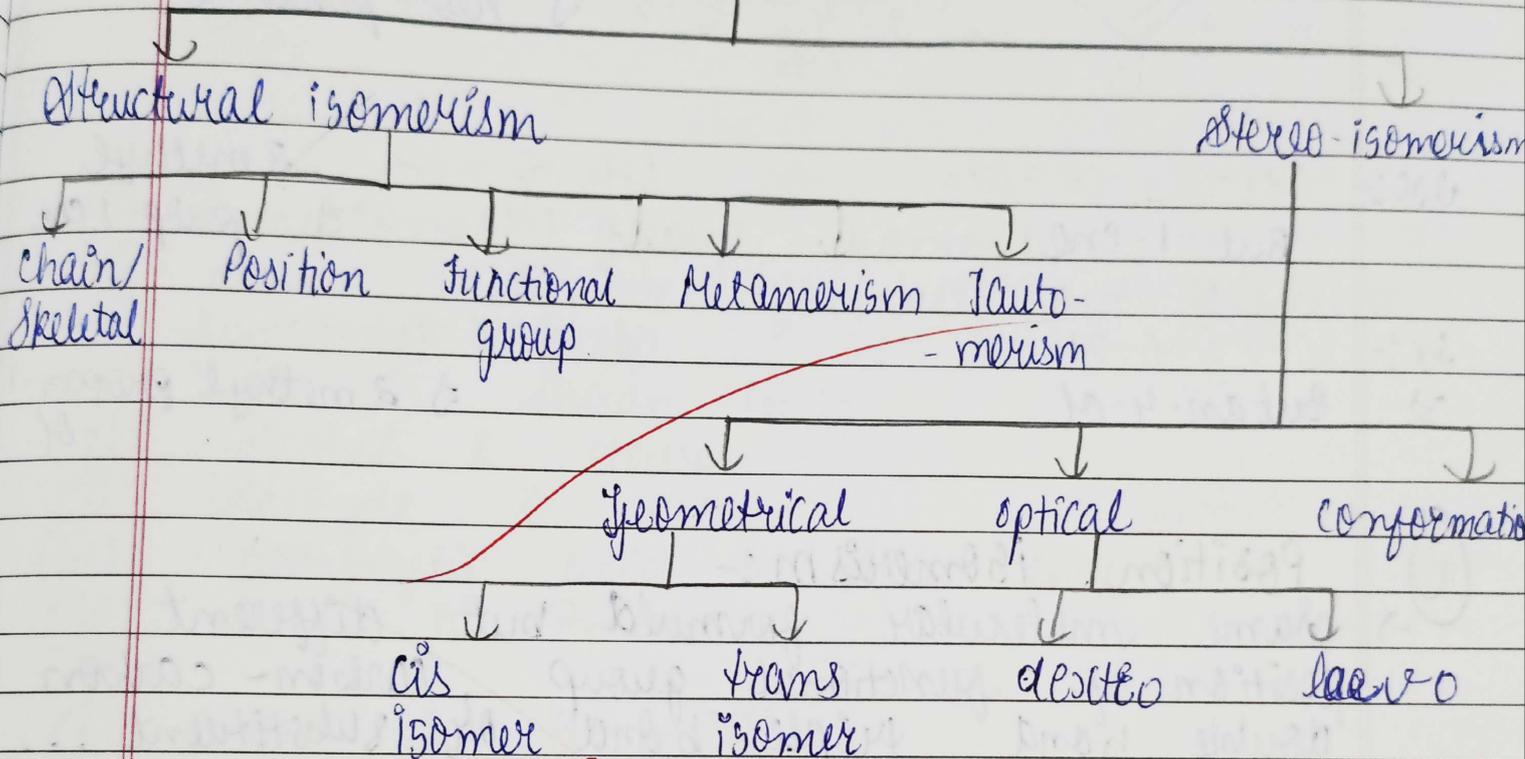


↓  
chain  
skelit

# \* Isomerism :-

→ When two or more molecule (compound) having same molecular formula, but different properties are called isomerism.

## Isomerism



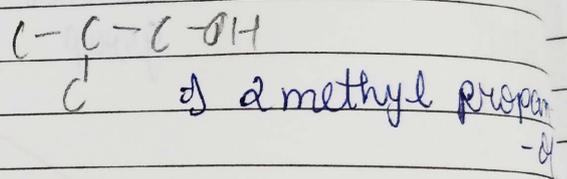
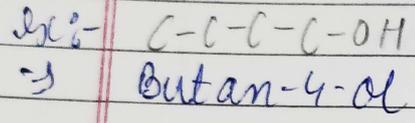
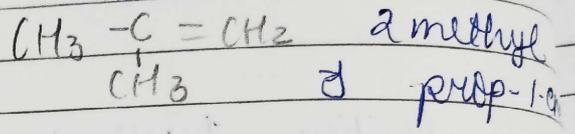
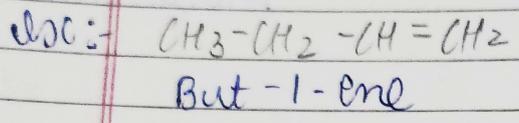
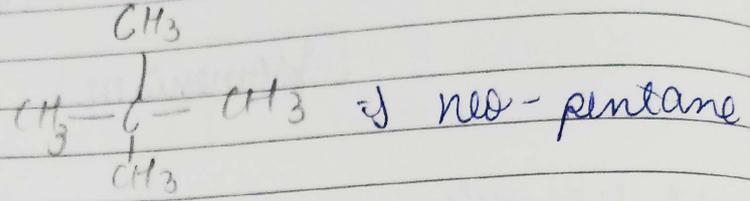
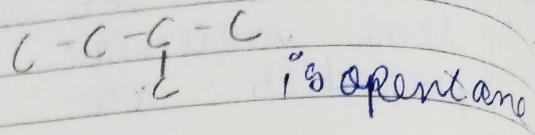
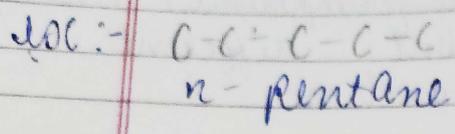
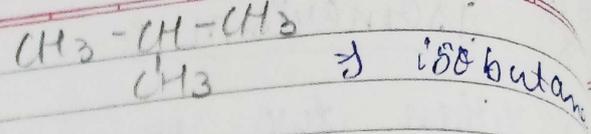
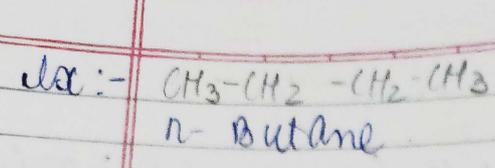
# \* Structural isomers :-

→ When 2 or more molecules having same molecular formula but different structure.

## ① Chain / skeletal isomerism :-

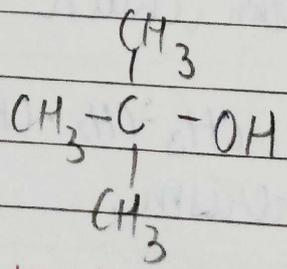
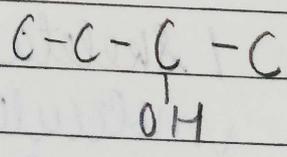
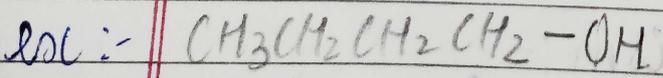
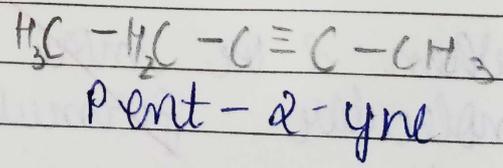
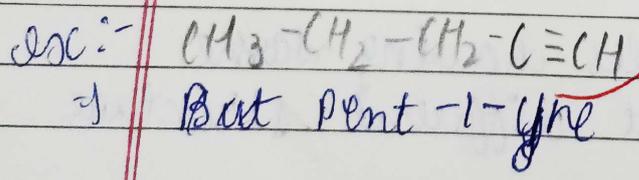
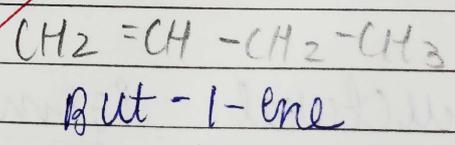
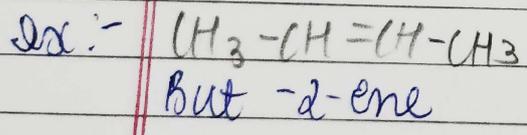
→ Same molecular formula but different arrangement of carbon chain are ...

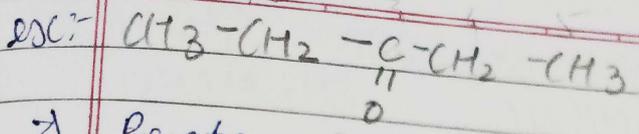
Note :-  $\text{CH}_4$ ,  $\text{CH}_3\text{-CH}_3$ ,  $\text{CH}_3\text{-CH}_2\text{-CH}_3$  does not show chain isomerism.



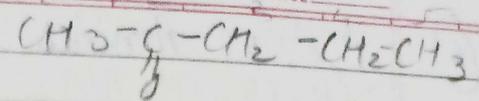
(a) Position isomerism:-

$\rightarrow$  Same molecular formula but different position of functional group, carbon-carbon double bond, triple bond or substituent...

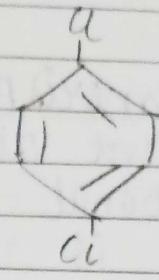
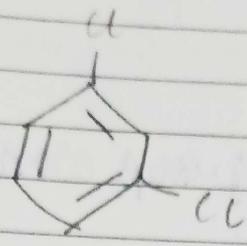
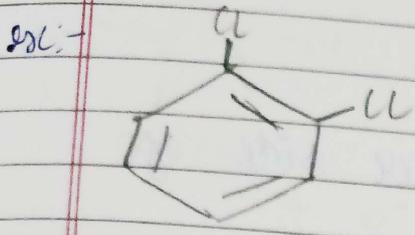




→ Pentan-3-one



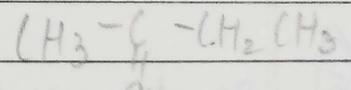
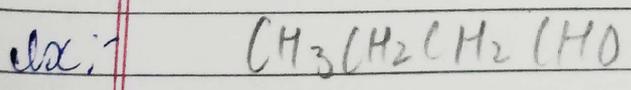
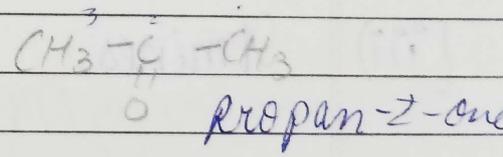
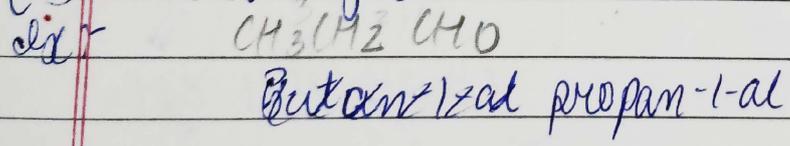
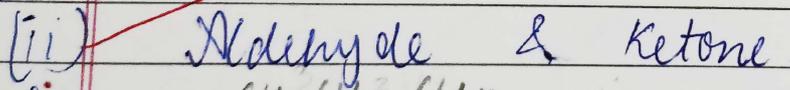
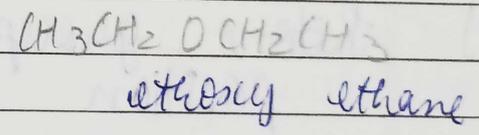
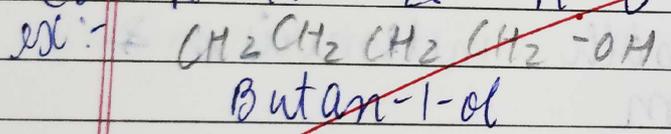
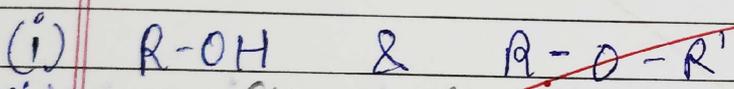
Pentan-2-one



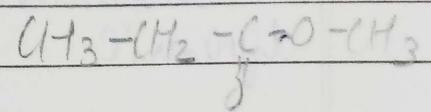
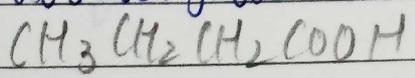
(3) Functional group isomerism :-

Same molecular formula but different functional group  
It is shown in :-

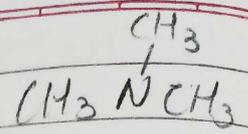
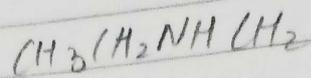
- (i) Alcohol & ether
- (ii) Aldehyde & ketone
- (iii) Carboxylic acid & ester
- (iv) 1°, 2°, 3° Amines



(3) Carboxylic acid & ester



(4) 1°, 2°, 3° Amines.  
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$



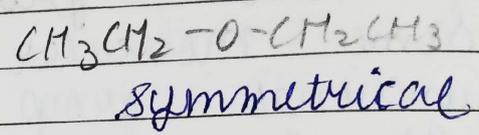
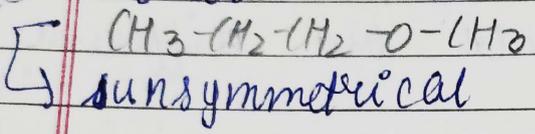
(4) Metamerism:-

→ Different alkyl group on either side of functional group.

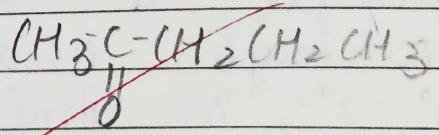
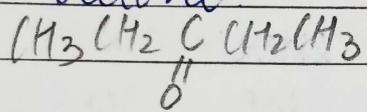
→ It is shown in:-

- (i) ether
- (ii) Ketone
- (iii) amines.

(i) ether

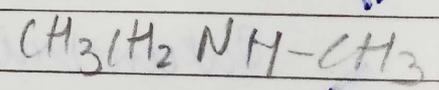
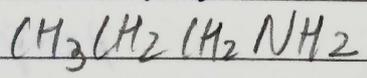


(ii) Ketone



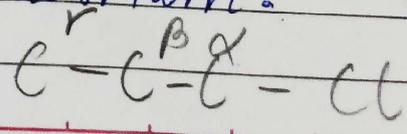
→ Ketone group shows both metamerism & position isomerism

(iii) Amines:-

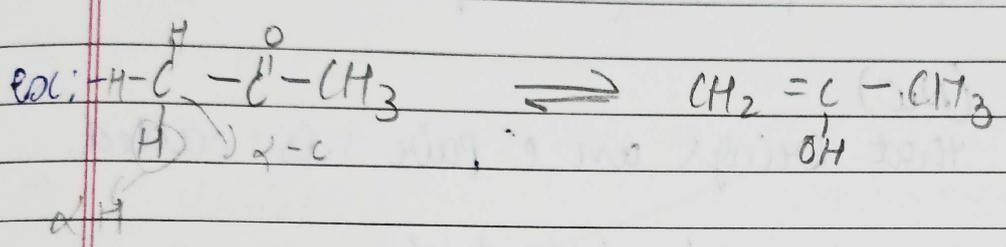
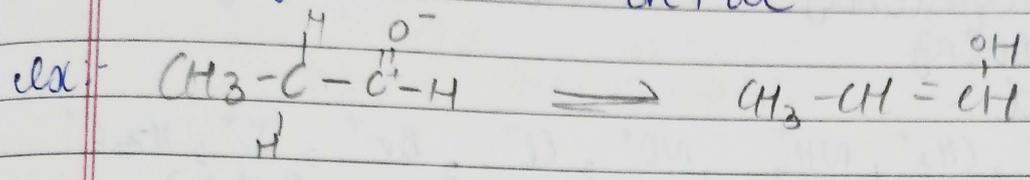
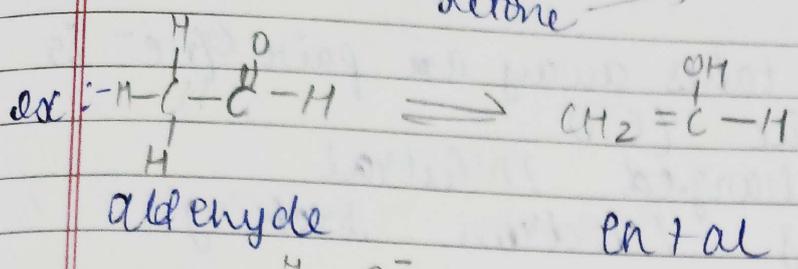


(5) Tautomerism:-

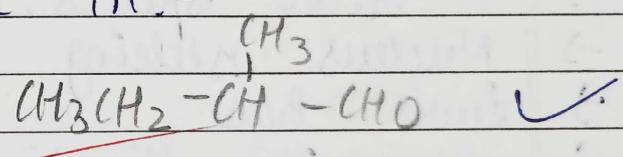
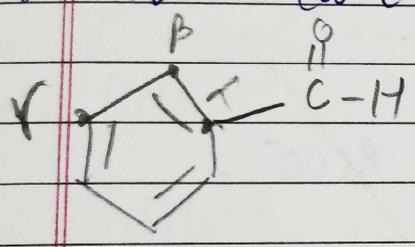
→ Same molecular formula but different arrangement of atom as well as they are in dynamic equilibrium.



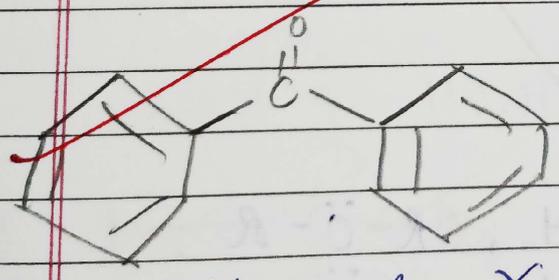
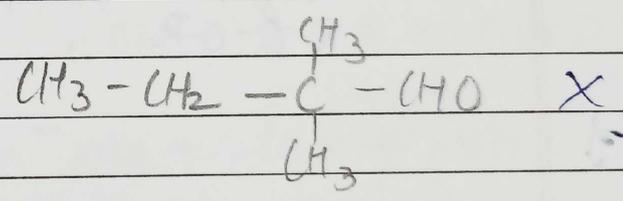
3) Aldehyde  $\rightarrow$  Alcohol  
Ketone  $\rightarrow$



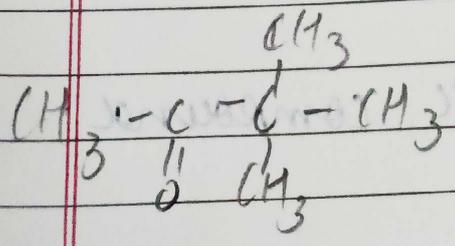
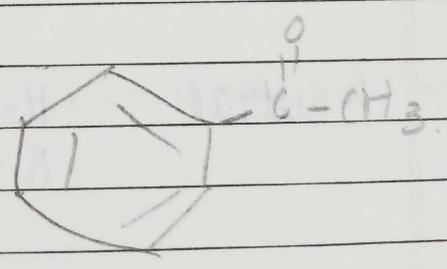
3) It can take place in:-



Benzaldehyde



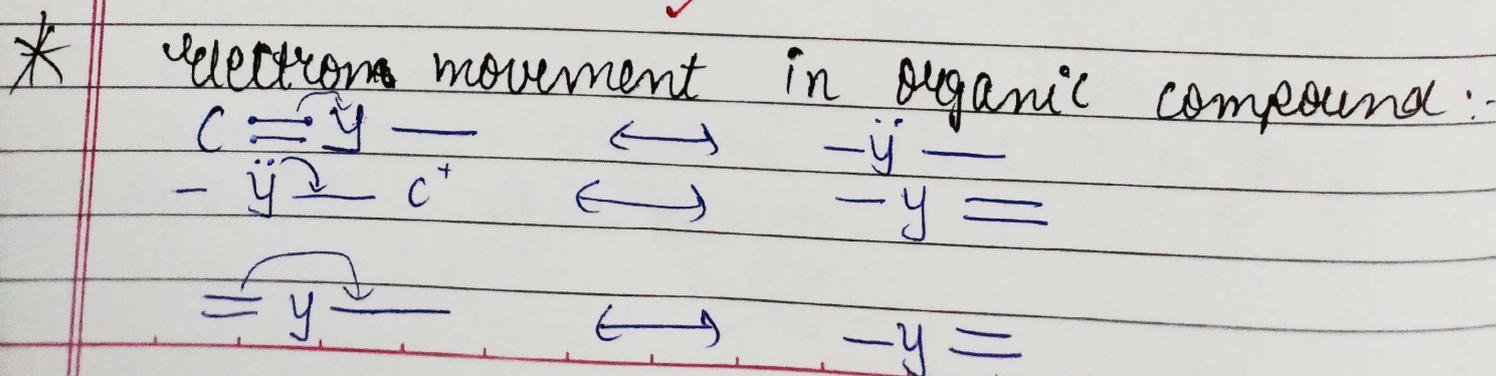
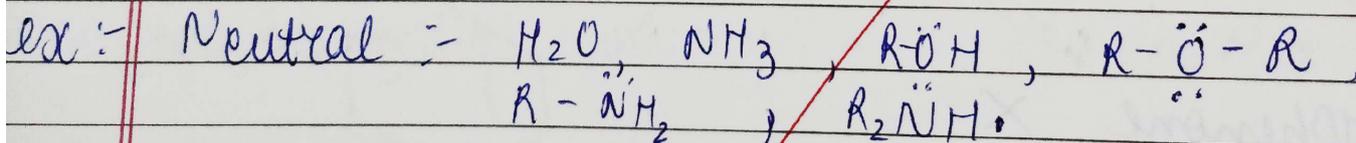
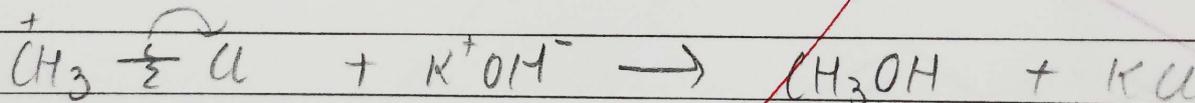
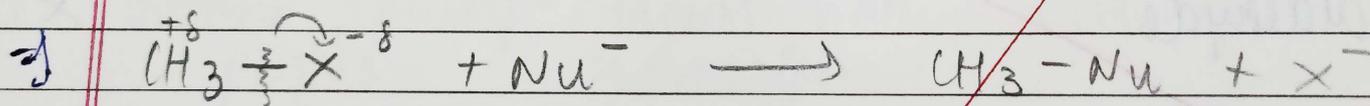
Benzophenone X



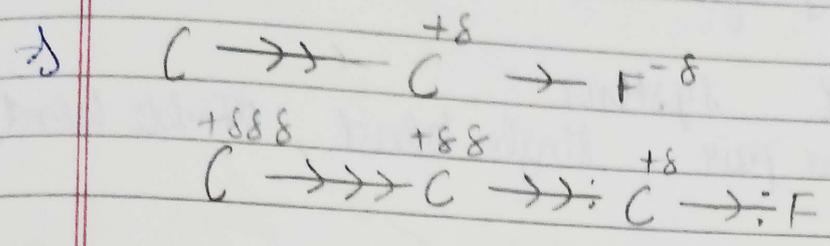
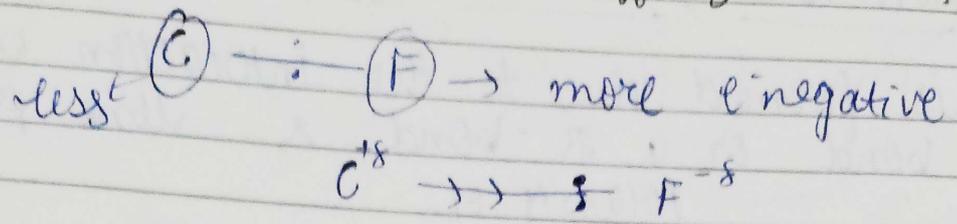
# \* Electrophile & Nucleophile :-

- 1) Electrophile:-  
 → A reagent that takes away a pair of  $e^-$  is called electrophile ( $E^+$ )  
 → It is positively charged / Neutral  
 → electron deficient / electron seeking  
 → electron loving  
 → Lewis acid  
 → Ex :-  $H^+$ ,  $CH_3^+$ ,  $NH_4^+$ ,  $NO^+$ ,  $Cl^+$ ,  $Br^+$ ,  $I^+$ ,  $H_3O^+$   
 → Neutral :-  $AlCl_3$ ,  $BF_3$  (Incomplete Octet)

- 2) Nucleophile ( $Nu^-$ )  
 → "A reagent that brings an  $e^-$  pair is called nucleophile.  
 → It is negatively charged / Neutral  
 →  $e^-$  rich species.  
 → Nucleus seeking  
 → Lewis Base  
 → Ex :-  $OH^-$ ,  $H^-$ ,  $F^-$ ,  $Cl^-$ ,  $Br^-$ ,  $I^-$ ,  $RCOO^-$ ,  
 $R-C-O-R$ ,  $R-O^-$



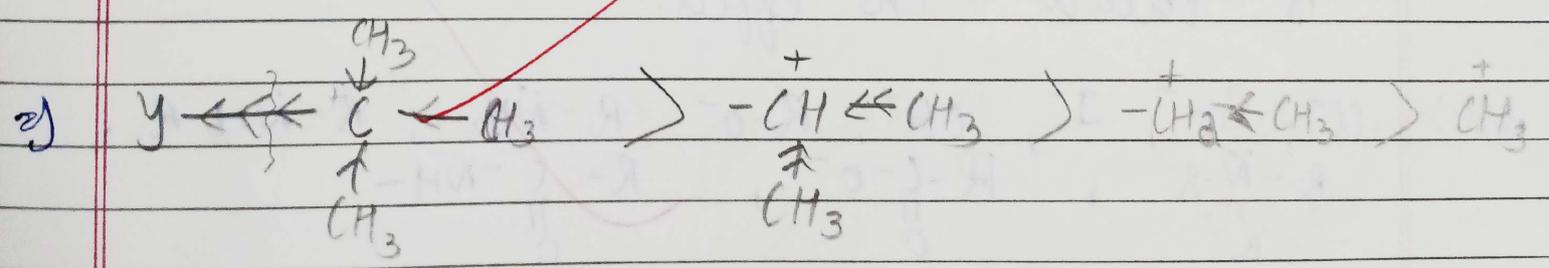
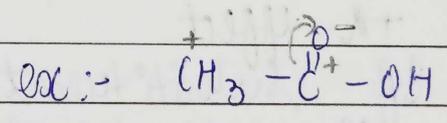
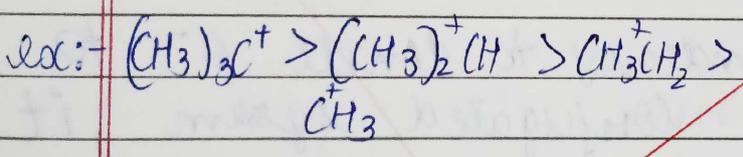
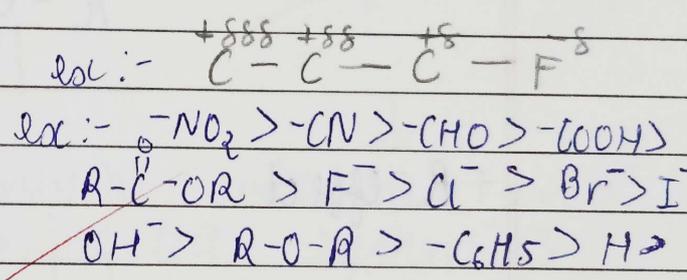
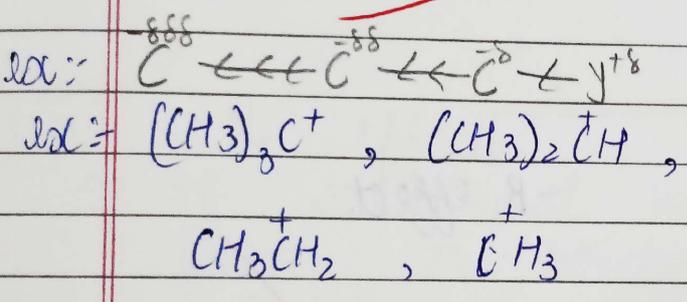
\* Inductive effect : (I effect)



I-effect.

→ +I-effect  
 e<sup>-</sup> donating group

-I effect  
 e<sup>-</sup> withdrawing group

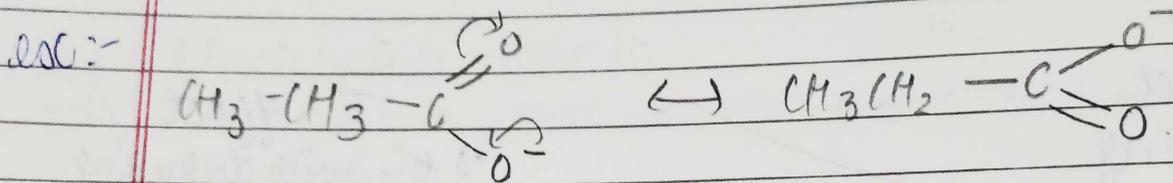
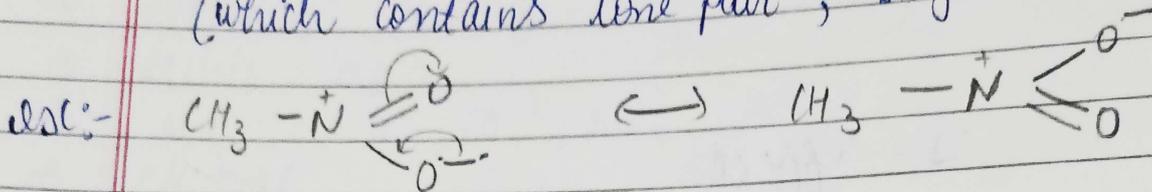


PAGE

# \* Resonance / Resonance Effect / Mesomeric - effect

→ It is formed due to the interaction b/w two  $\pi$  bond or,  $\pi$ -bond & lone pair  
polarity of

→ It is conjugated system  
(which contains lone pair, single bond, double bond)



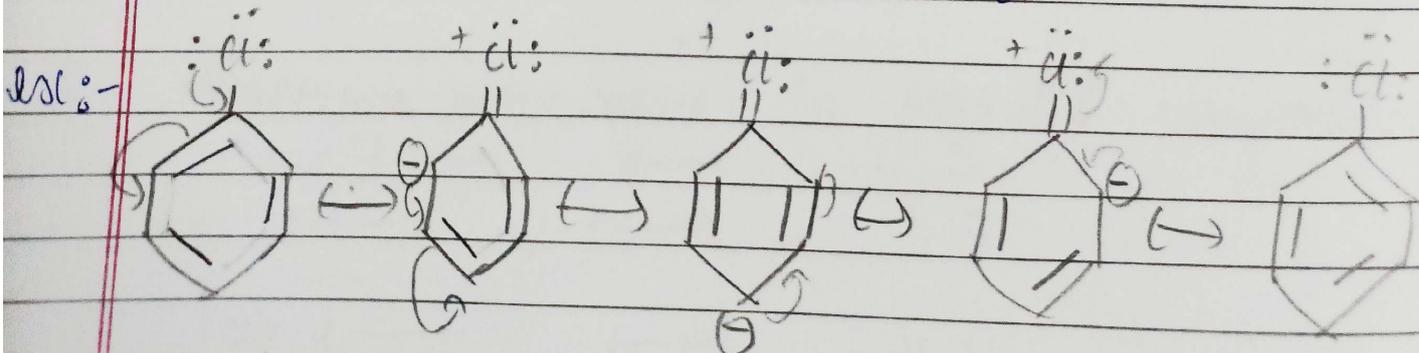
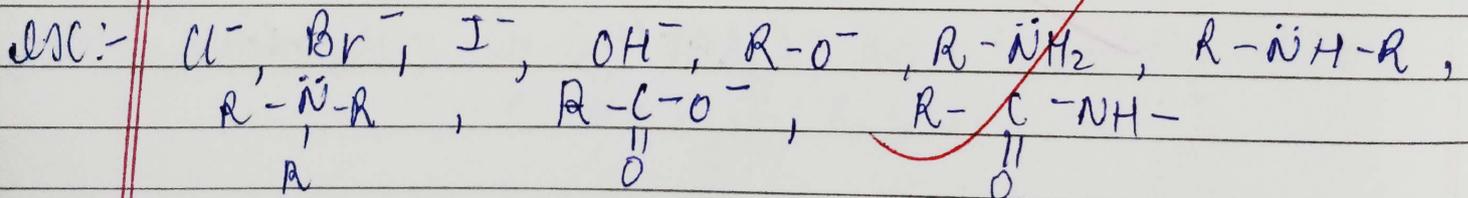
## R-effect

+R-effect

-R effect

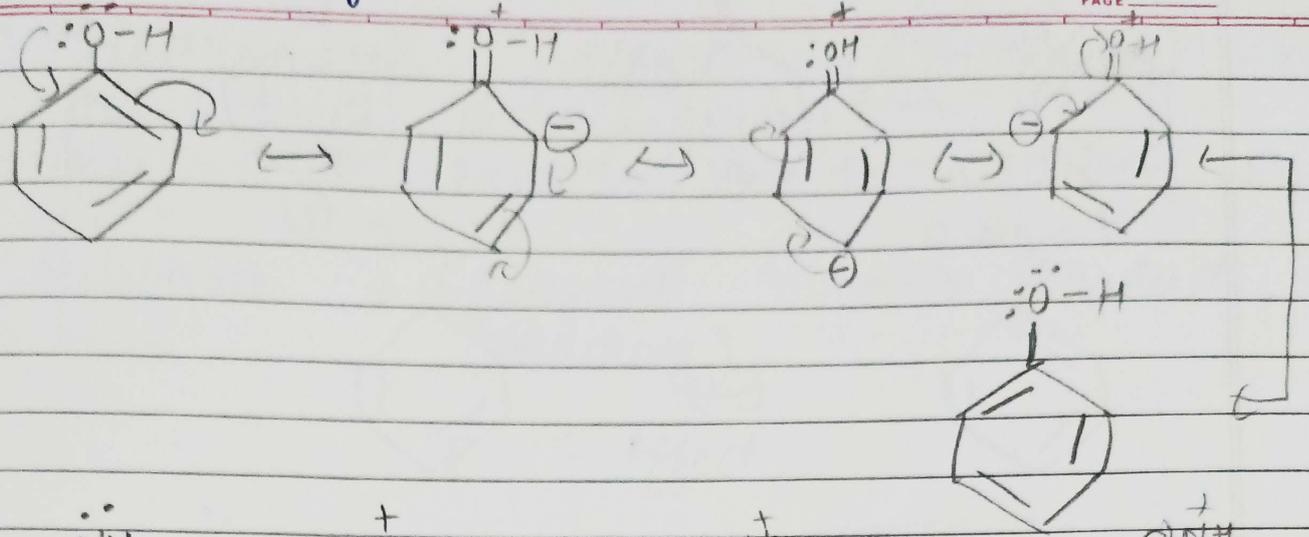
(i) +R-effect

→ If substituent has tendency to donate  $e^-$  to the  $\pi$  bond or conjugated system, it is called +R effect.

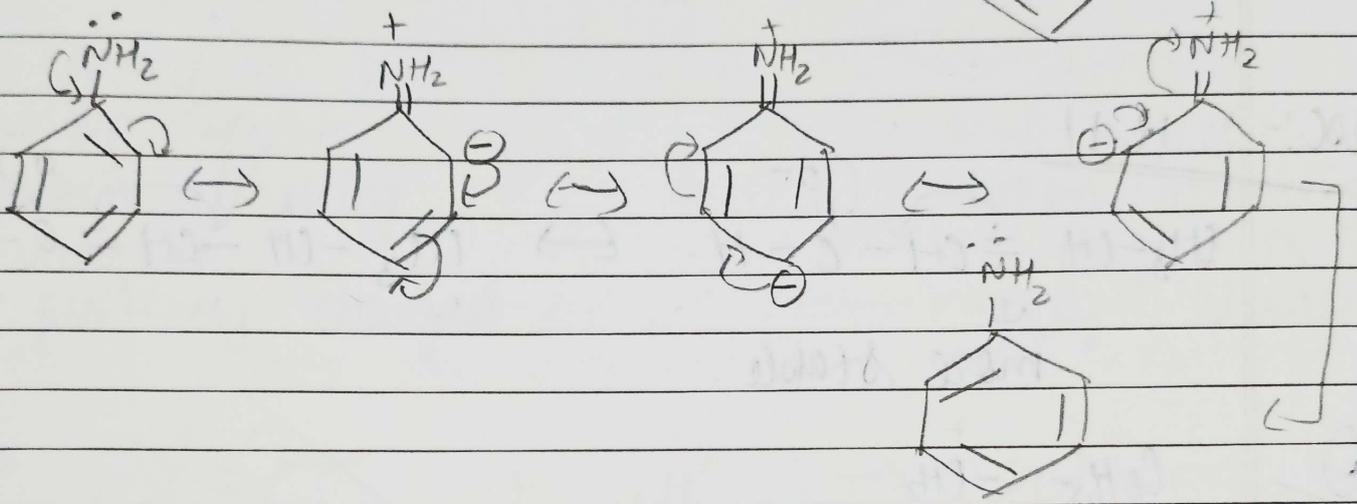


$C-C \Rightarrow 154 \text{ pm}$   
 $C=C \Rightarrow 134 \text{ pm}$   
 $C-C$  bond length in benzene is  $139 \text{ pm}$

ex:-

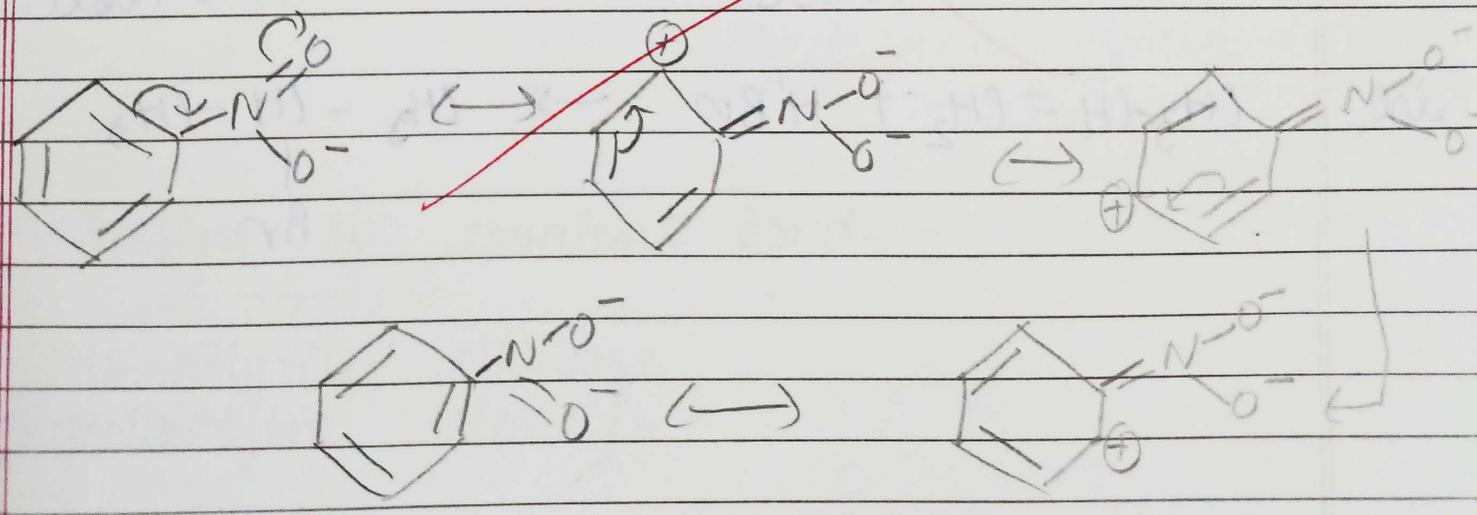


ex:-

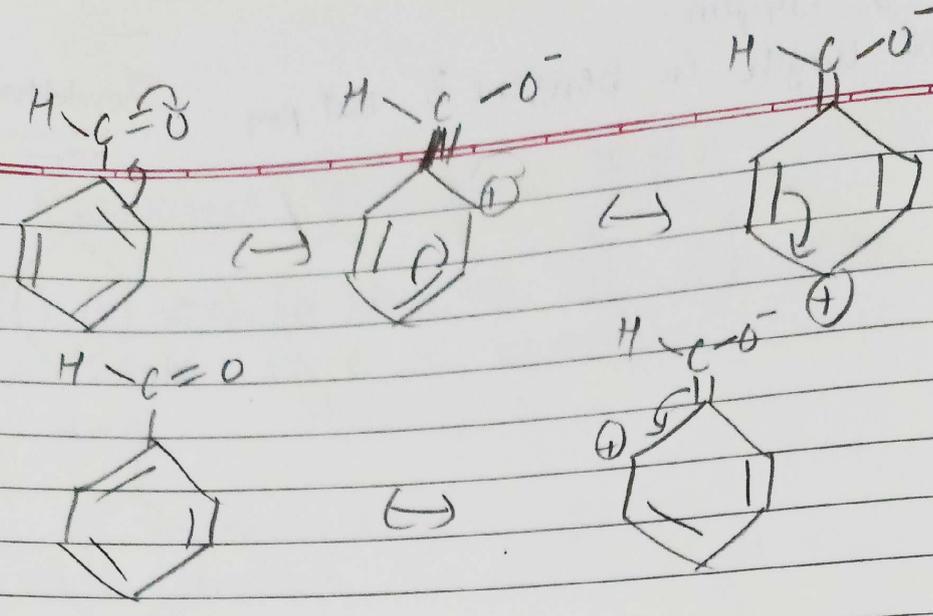


(ii) -R effect.  
 → If substituent has tendency to withdraw an  $e^-$  from  $\pi$  bond or conjugated system is called           .

ex:-  $-NO_2$ ,  $Cl$ ;  $-CHO$ ,  $-COOH$ ,  $>C=O$ .

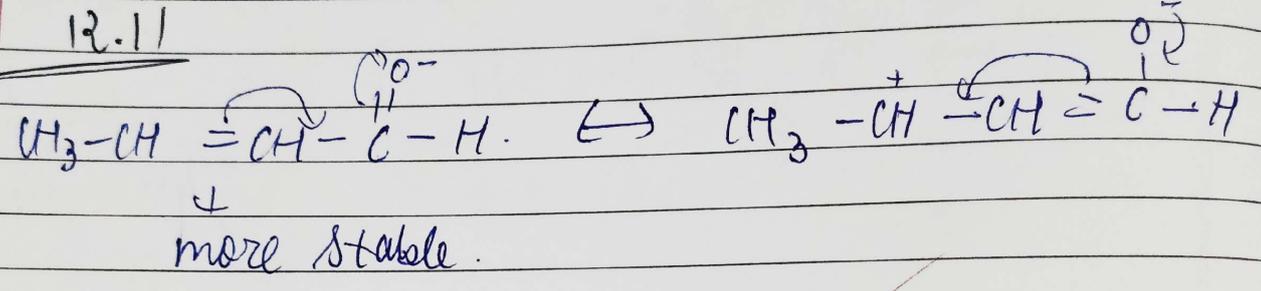


ex:-

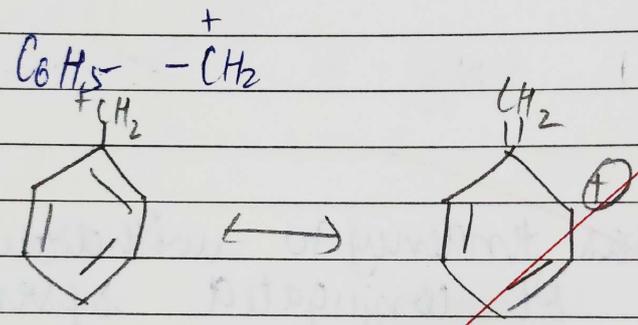


QAC:-

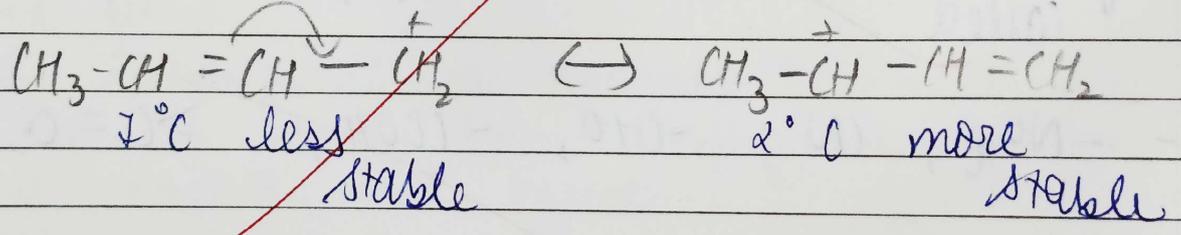
12.11



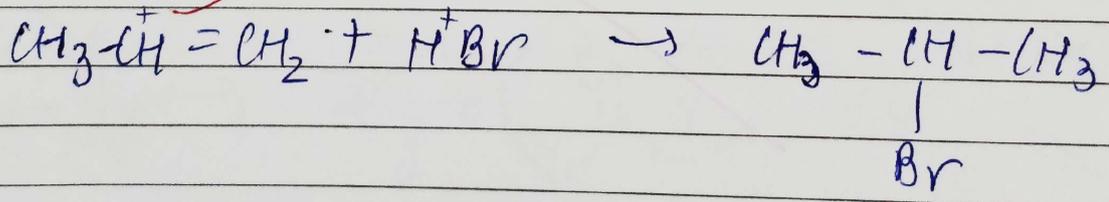
~~Q~~



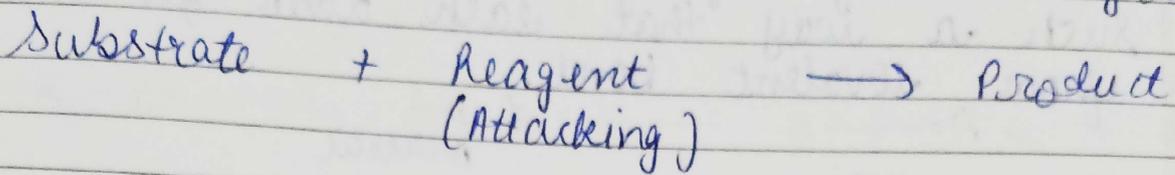
~~Q~~



sol:-



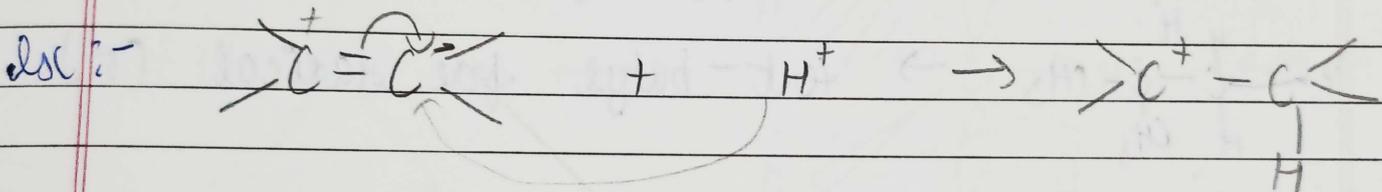
\* Electromeric effect (E<sup>-</sup> effect).  
 This effect is temporary.  
 This is caused due to attacking reagent.



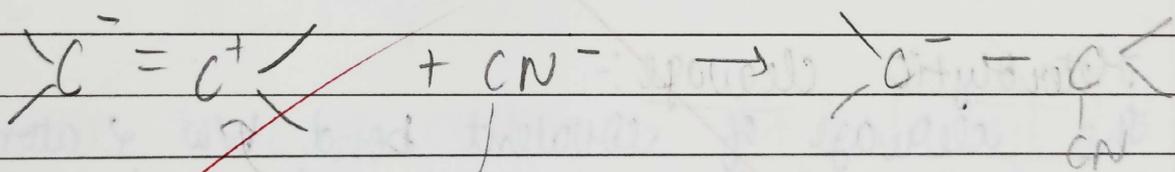
E<sup>-</sup> effect

→ +E effect when attacking reagent is positively charged

-E effect when attacking reagent is -vely charged



+E effect



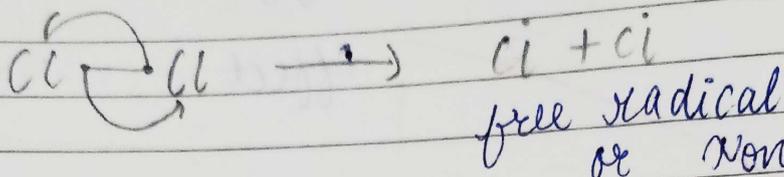
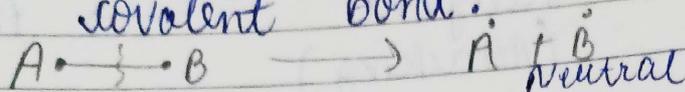
-E effect

\* Fission of covalent bond :-  
 $\text{C} - \text{C}$

- 1) Homolytic cleavage
- 2) Heterolytic cleavage

# ① Homolytic cleavage:

→ The cleavage of covalent bond b/w 2 atom in such a way that each atom get an e<sup>-</sup> from covalent bond.



⇒ ↷

→ Fish Hook or half headed

→ CH<sub>3</sub> → Primary, CH<sub>3</sub>-CH<sub>2</sub>

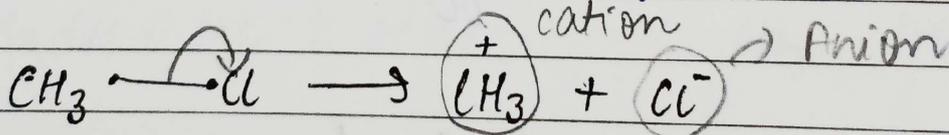
→ CH<sub>3</sub>- $\dot{C}$ -CH<sub>3</sub> → isopropyl free radical (2°)

→  $\begin{matrix} H & H \\ | & | \\ H-C & -C-CH_3 \\ | & | \\ H & CH_3 \end{matrix}$  → tert-butyl free radical (3°)

→ Stability Order. → 3° > 2° > 1° > CH<sub>3</sub>

# ② Heterolytic cleavage:-

→ The cleavage of covalent bond b/w 2 atom in such a way that one of the atom get both e<sup>-</sup> from covalent bond is called heterolytic cleavage



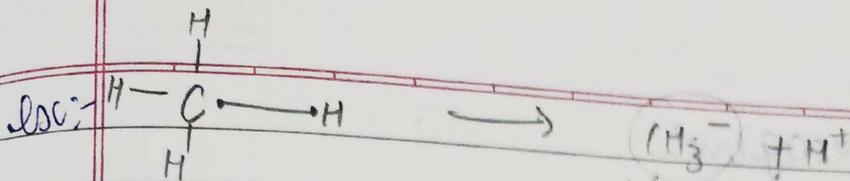
old carbonium

↓  
carbocation

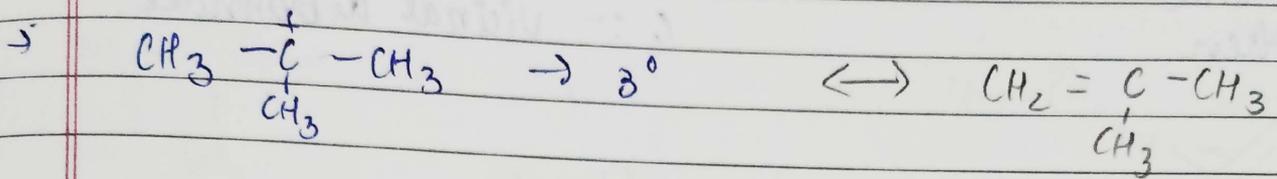
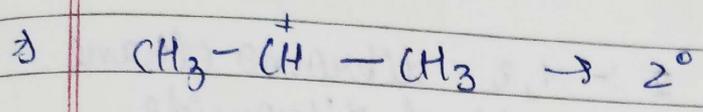
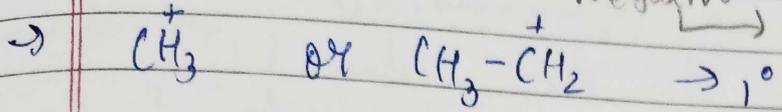
Charged species → polar  
Ionic atom

→  $A \text{---} B \longrightarrow A^+ + B^-$  ∴ B is more e<sup>-</sup> negative

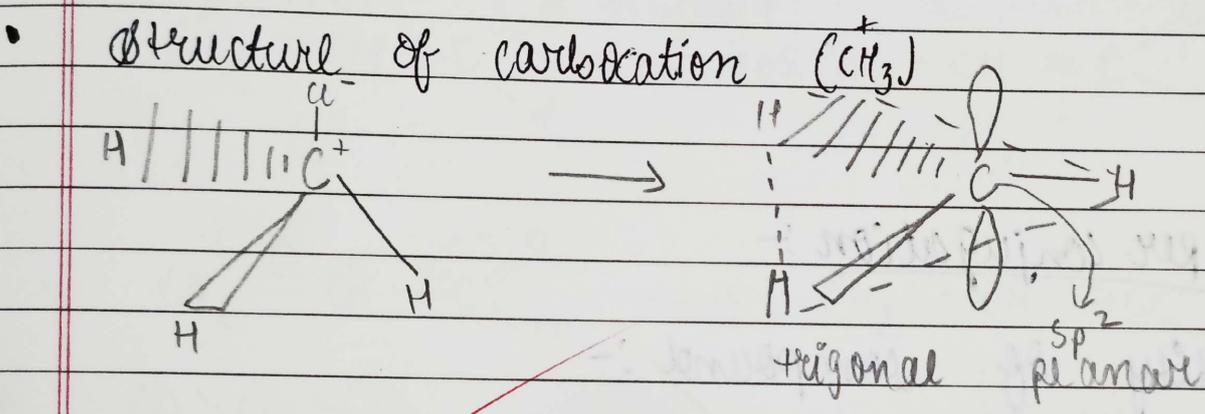
$A \text{---} B \longrightarrow A^- + B^+$  → A is more e<sup>-</sup> negative



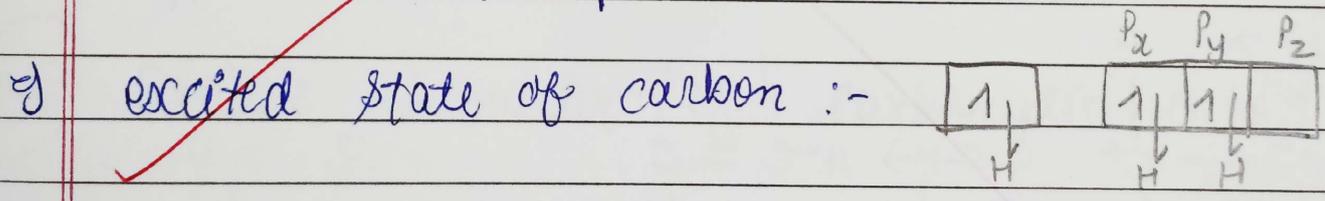
Negative  $\longrightarrow$  Carbanion



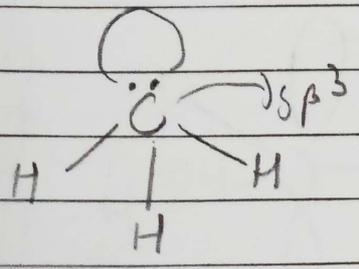
• Stability of carbocation:-  
 $(\text{CH}_3)_3\text{C}^+ > (\text{CH}_3)_2\text{CH}^+ > \text{CH}_3\text{CH}_2^+ > \text{CH}_3^+$   
 $3^\circ > 2^\circ > 1^\circ > \text{CH}_3^+$



e.c :  $1s^2 2s^2 2p^2$

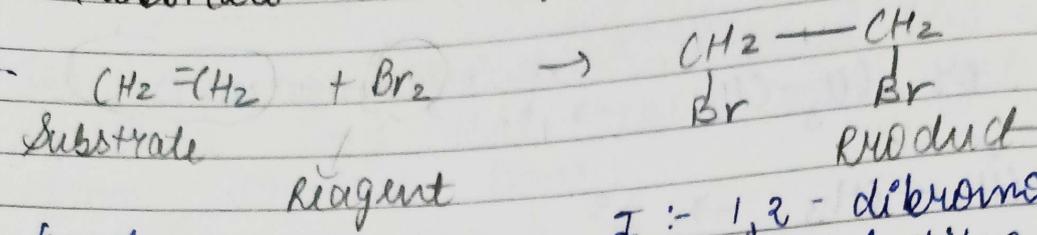


• Shape of carbanion :-  $(\text{CH}_3)^-$  or  $:\text{CH}_3^-$



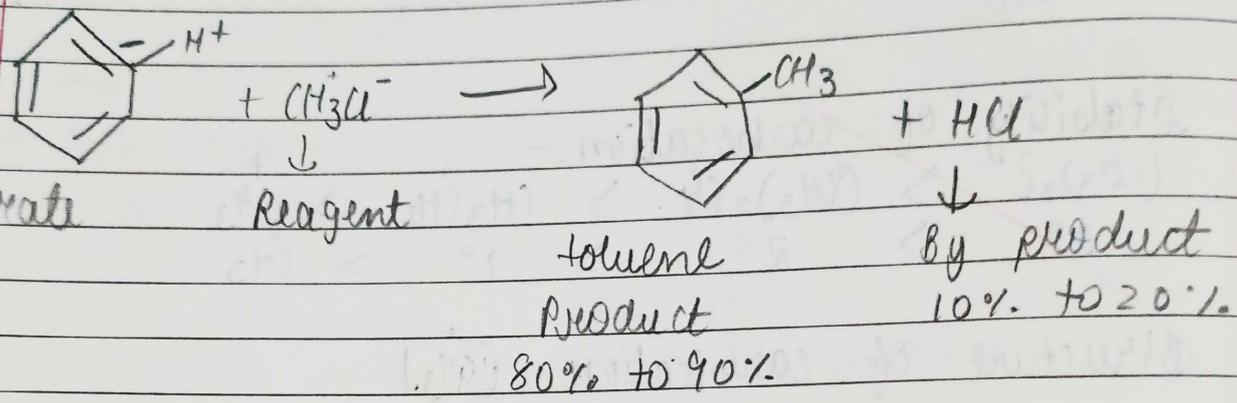
$\rightarrow$  Distorted tetrahedral

\* Substrate & reagent:-



old bond is broken

I :- 1,2-dibromo ethane  
C :- vicinal dibromide.



\* Hyper conjugation:-

→ Stability of compound:-

