ORGANIC CHEMISTRY

IUPAC : International union of pure and applied chemistry.

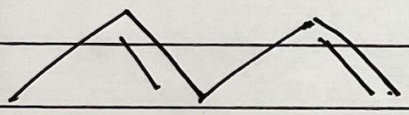
① Hybridisation :

σ + no. of L.P = 4	sp^3
σ + no of L.P = 3	sp^2
σ + no. of L.P = 2	sp

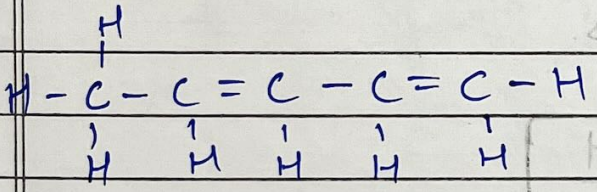
- No. of L.Ps can be zero.
- L.P should be localised.

② Ends & Bents represent a carbon.

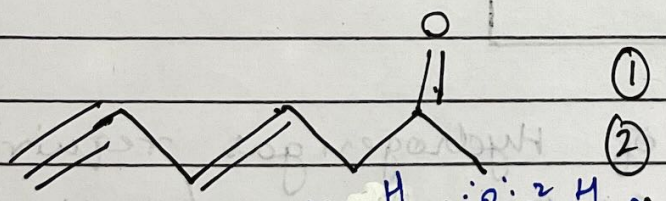
(a)



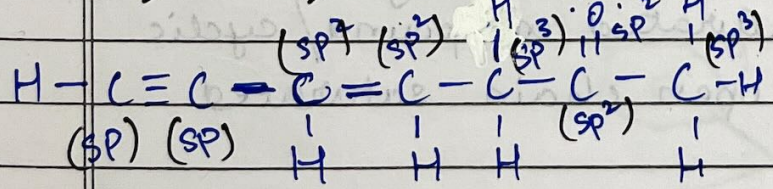
① no. of σ bonds : 12
② no. of π bonds : 2
③ No. of sp^3 & sp^2 hybridised carbon : 1 / 4



(b)



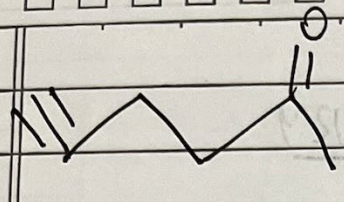
① No. of σ bonds : 15
② No. of π bonds : 4



③ sp^3 hybrid atoms : 2
④ sp^2 hybrid atoms : 4

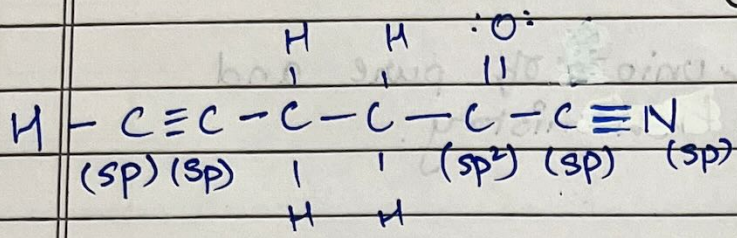
⑤ No. of C-H bonds - 8
⑥ No. of C-C bonds - 6
No. of C-C single bond - 4

(c)



(1) π bonds - 5

(2) σ bonds - 12



(3) sp^2 atoms - 1

(4) sp^3 atoms - 2

(5) sp atoms - 4

Degree of unsaturation (DU)
(or) Index of hydrogen deficiency (IHD)
(or) Double Bond equivalent (DBE)

O.C

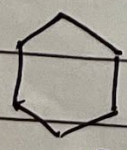
Saturated Alkanes → Unsaturated Alkenes, Alkynes.

⇒ $$DU = \frac{(2C + 2 + N) - X - H}{2}$$

→ The no. of moles of Hydrogen gas required to convert unsaturated compound/cyclic compound into open chain saturated compound.

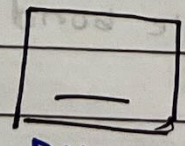
KIM DU = 1 → 1 ring / 1 double bond.

Qy (a)



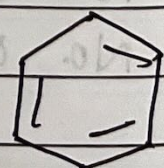
DU = 1

(b)



DU = 2

(c)



DU = 4

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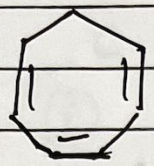
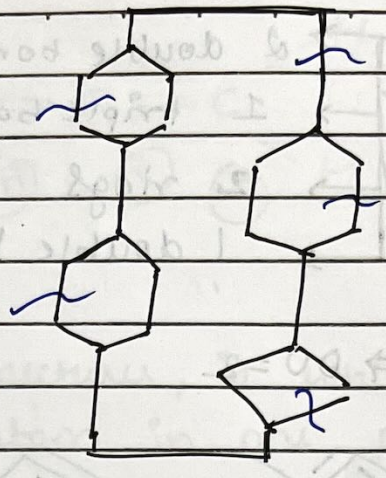
(d)



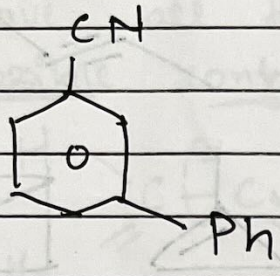
DU = 4

(e)



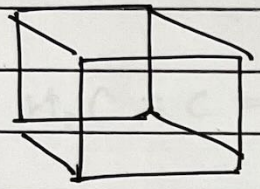
DU = 5

(f)



DU = 10

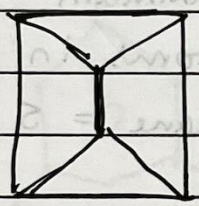
(g)



(C_8H_8)

$DU = \frac{2C+2-H}{2} = \frac{16+2-8}{2} = 5. = DU$

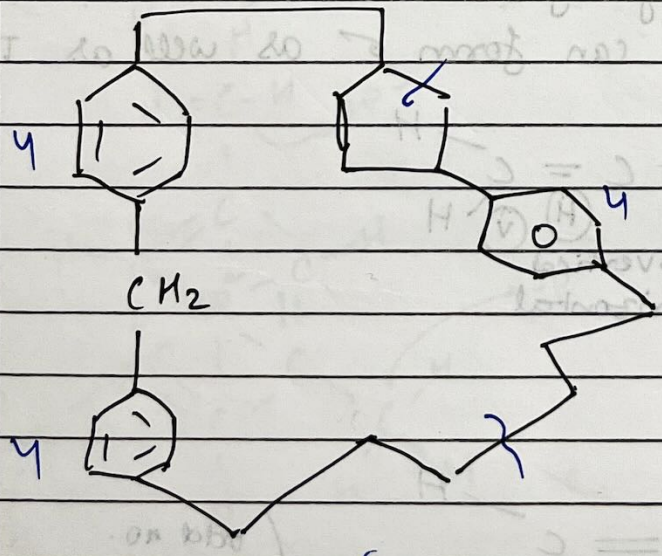
(h)



(C_6H_6)

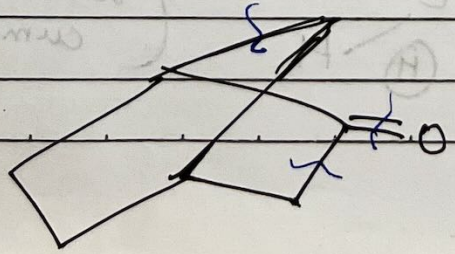
$DU = \frac{2C+2-H}{2} = \frac{12+2-6}{2} = 4$

(i)



DU = 14

(j)

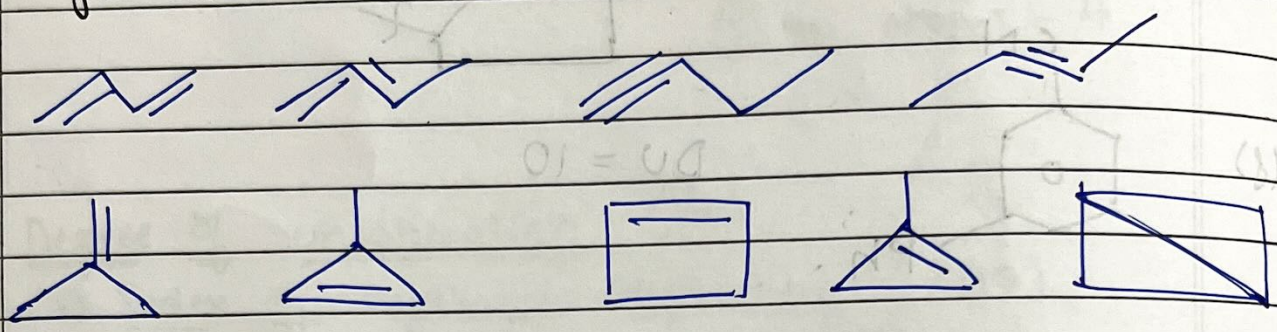


DU = 3

KIM

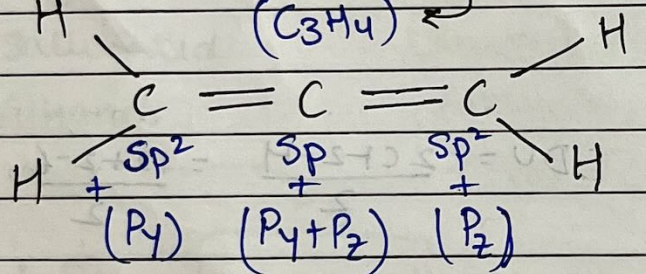
DU = 2 → 2 double bond
→ 1 triple bond
→ 2 rings
→ 1 double bond + 1 ring.

eg: C_4H_6 ⇒ DU = 2



Structure of Allenes molecules :

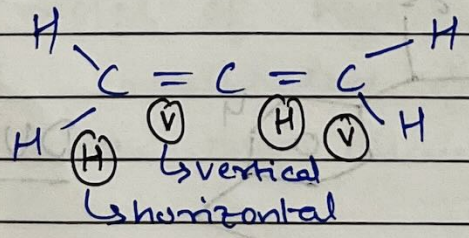
(C_3H_4)



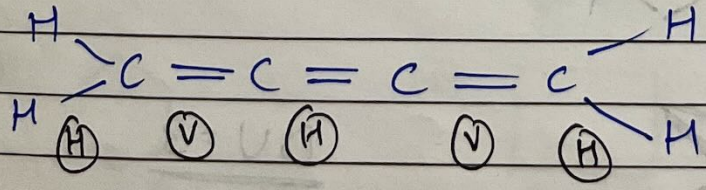
⇒ maximum no. of atoms in a plane = 5.

KIM : ↓ Hybrid orbitals always forms 'σ' bonds
Pure orbitals can form σ as well as π

C_3H_4 ⇒



Cummelenes



(odd no. cummelenes)

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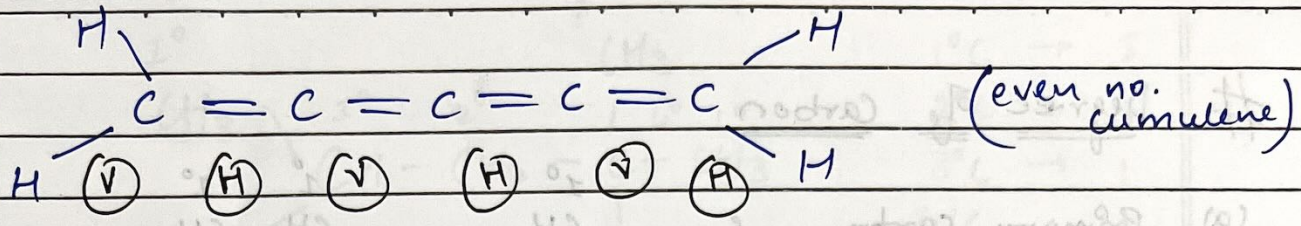
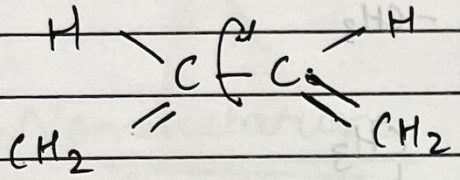
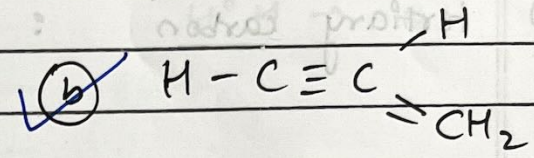


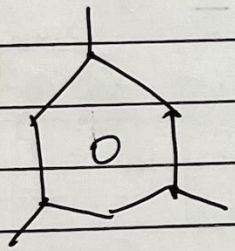
Q) In the following structures, in which option(s) will have all the atom in one plane in all possible conformations.

(a) 

(b) 

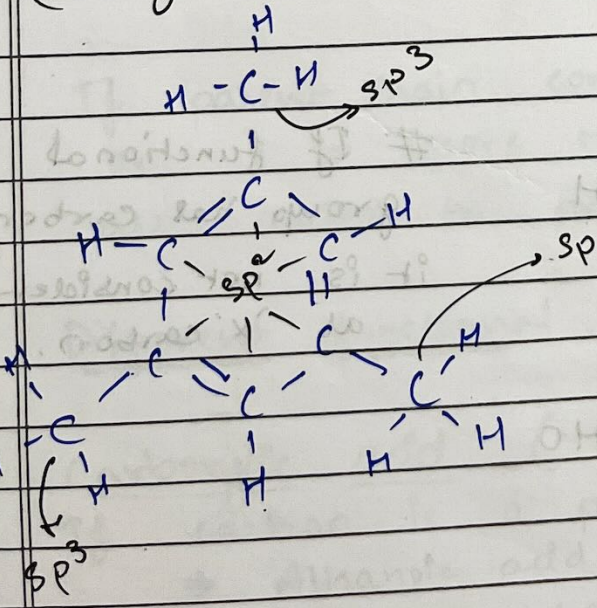
(c) $H_2C=C=O$

(d) $H_2C=C=CH_2$ (Allenes)

Q) 

(Mesitylene)

(a) Find Total no. of hybrid orbitals.
(b) Total no. of pure orbitals.
(c) no. of sp^2 & sp^3 hybrid carbons.
(d) Total no. of 'σ' & π bond.
(e) Maximum no. of atoms in same plane.



$sp^3 \rightarrow 3$

$sp^2 \rightarrow 6$

$\sigma = 21$

$\pi = 3$

(e) $\Rightarrow$ 15

(b) 18

(a) $12+18 \Rightarrow 30$

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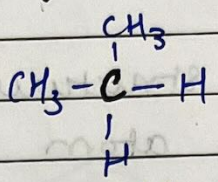
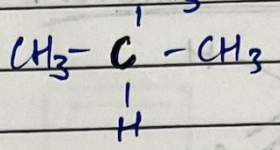
Degree of carbon

(a) Primary carbon : $\overset{1^\circ}{CH_4}$ $\quad \overset{1^\circ}{CH_3}-\overset{1^\circ}{CH_3}$

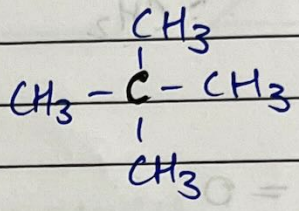
(b) secondary carbon :



(c) tertiary carbon :



(d) quaternery carbon :

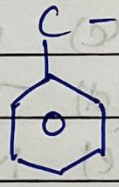


KIM :

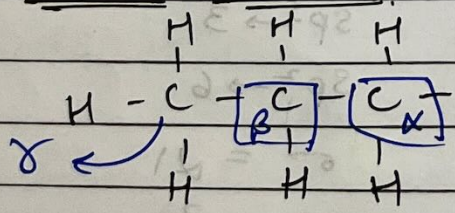
(1) Allylic carbon : $C=C-CH_2-$

(2) Venylic carbon : $C=C-$

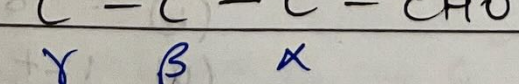
(3) Benzylic carbon :

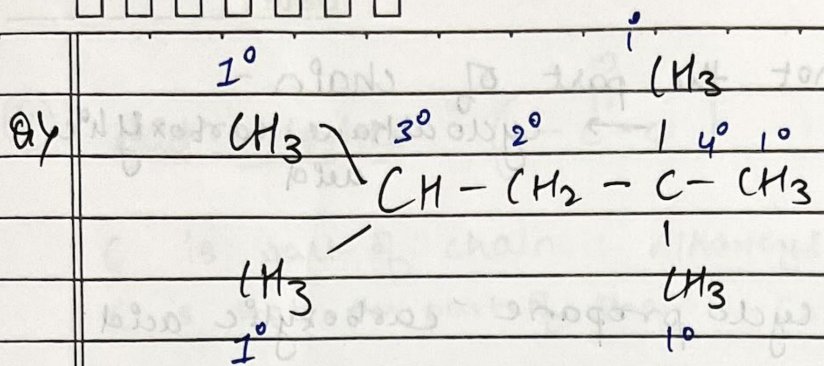


⇒ α, β, γ carbon -



If functional group has carbon it is not considered as 'α' carbon.



Q4


(iso octane)

1°C →	5
2°C →	1
3°C →	1
4°C →	1
1°H →	15
2°H →	2
3°H →	1
4°H →	0

Nomenclature

Prefix + Rootword + suffix

2° prefix + 1° prefix + root word + 1° suffix + 2° suffix

- 2° prefix → functional group
- 1° prefix → cyclo
- root word → No. of carbons in principal carbon chain
- 1° suffix → ene, yne, ane
- 2° suffix → Principal functional group.

→ If parent chain contains 2 or more double bond or 2 or more triple bond, di, tri, etc. are added to primary prefix

→ Different functional groups (2° suffix)

① Carboxylic acid ($-COOH$) ($-\overset{O}{\overset{\|}{C}}-OH$)

→ If carbon is a part of the chain.

⇒ Alkanoic acid.

eg: $CH_3.CH_2\,CH_2\,COOH$ ⇒ Butanoic acid
④ ③ ② ①

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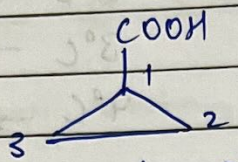
→ If carbon is not the part of chain -
→ cycloalkane carboxylic acid

eg :



→ cyclo propane carboxylic acid.

⇒ Root word : 1C → meth, 2C → eth, 3C → prop, 4C → but, 5C → pent, 6C → Hex, 7C → Hept, 8C → Oct, 9C → Non, 10C → Dec

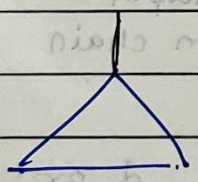
11C → Undec

12C → Dodec.

$R-\overset{O}{\overset{\|}{C}}-NH_2$ (amide)

→ If (C) is considered in the chain → Alkanamide.

If (C) is not considered in the chain → Carboxamide.



③ Aldehyde $\left(-\overset{O}{\overset{\|}{C}}-H\right)$

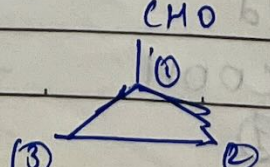
(in chain)

C is considered : : Alkanal

C is not considered : [redacted]. Carbaldehyde.

eg : ⇒ $CH_3CH_2CH_2CHO$ → Butanal

⇒



cyclopropane carbaldehyde.

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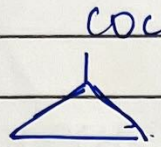
(4) Acid chloride $\left(-\overset{\overset{O}{\|}}{C}-Cl\right)$

C is part of chain : Alkanoyl chloride.
C is not the part of chain : Carbonyl chloride.

eg: CH_3CH_2COCl → propanoyl chloride.

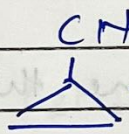


→ cyclopropane carbonyl chloride.

(5) Cyanide $(-CN)$

C is a part of chain : Alkane Nitrile.
C is not part of chain : Alkane carbonitrile.

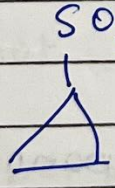
eg: $CH_3-CH_2-CH_2-CN$ → Butane Nitrile.



→ cyclo propane carbonitrile.

(6) Sulphonic acid $\left(-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-OH\right)$

$CH_3CH_2CH_2SO_3H$ → propane sulphonic acid.



→ cyclopropane sulphonic acid.

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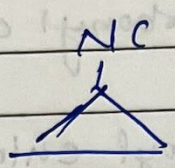
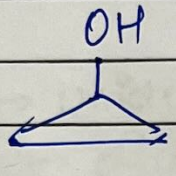
(7) Isocyanide (-NC) / $-N^{\oplus}\equiv C^{\ominus}$

$CH_3CH_2CH_2-NC$ → propane isonitrile.



→ cyclopropane isonitrile.

(8) Alcohol (-OH)

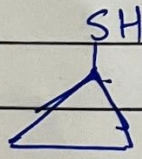


→ cyclopropanol

$CH_3-CH_2-CH_2-OH$ → propanol

(9) Thio-alcohol (-SH)

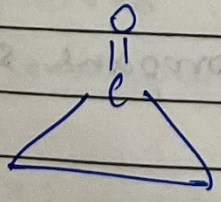
CH_3CH_2-SH → Ethane thiol



→ cyclopropane thiol.

(10) Ketone $(-\overset{\overset{O}{\|}}{C}-)$

$CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ → propanone.



→ cyclopropanone.

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(11) **Amine** $(-NH_2)$ → Alkanamine.

for cyclic (cyclo-alkanamine

Amine → 1° $R-NH_2$

→ 2° $R-NH-R$

→ 3° $R-\underset{\underset{R}{|}}{N}-R$

$CH_3CH_2CH_2NH_2$ → propanamine.

★ $CH_3-NH-CH_3-CH_2-CH_3$

N-methyl-propanamine.

$CH_3-\underset{\underset{CH_2-CH_3}{|}}{N}-CH_3$ N, N dimethyl ethanamine.

$CH_3-\underset{\underset{C_2H_5}{|}}{N}-C_3H_7$ N-methyl-N-ethyl propanamine.

→ alphabetical order.

(12) **Esters** : $\left(R-\overset{\overset{O}{\|}}{C}-O-R\right)$.

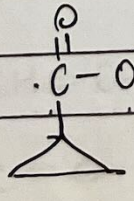
C is part of chain → Alkyl Alkanoate

C is not a part of chain → Alkyl cycloalkane carboxylate

$CH_3CH_2CH_2-\overset{\overset{O}{\|}}{C}-OC_2H_5$

④ ③ ② ①

ethyl butanoate



ethyl cyclopropane carboxylate

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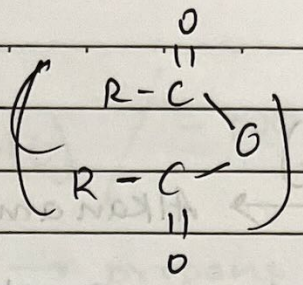
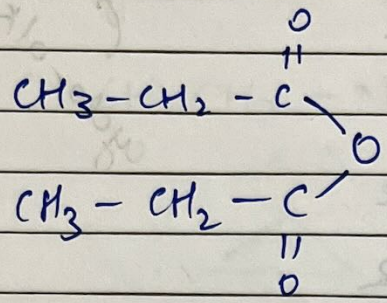
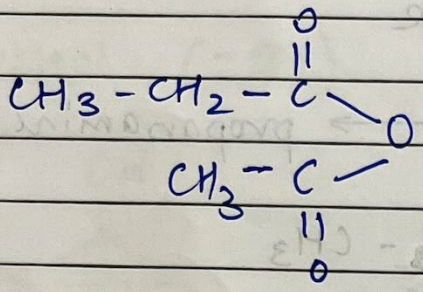
(13) Acid Anhydride





propanoic anhydride



Ethanoic propanoic anhydride.

Secondary Prefix ⇒ groups considered as substituent or side chain.

⇒ Can be a functional group like –

–F , –Cl , –Br , –I , $-NO_2$, –NO , –OR

fluoro , chloro , Bromo , Iodo , Nitro , Nitroso , Alkoxy

→ always acts as substituents.

⇒ –R → Alkyl

$-CH_3$ → methyl

$-CH_2CH_3$ → ethyl

$-CH_2CH_2CH_3$ → propyl

Date :

$CH_3-CH(CH_3)-CH_2-$ — iso-butyl. (2' methyl propyl)

$CH_3-CH(CH_3)-$ — iso propyl. (1' methyl ethyl)

$CH_3-C(CH_3)_2-CH_2-$ — neo-pentyl. (2,2 dimethyl propyl)

$CH_3-CH_2-CH(CH_3)-$ — sec butyl. (1 methyl propyl)

$CH_3-C(CH_3)_2-$ — tert butyl. (1,1 dimethyl ethyl)

$CH_2=$ → methylidene.

$CH_3-CH=$ → ethylidene.

$CH_3-CH_2-CH=$ → propylidene.

$CH_2=CH-$ → Vinyl / ethenyl

$CH_3-CH=CH-$ → propenyl

$C=C-C-$ → Allyl

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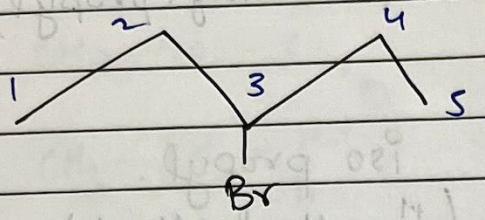
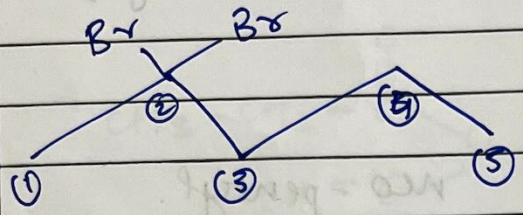
Date :

Nomenclature of Hydrocarbons

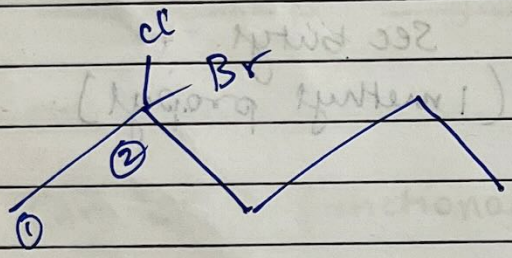
(1) 

3-bromo pentane.

(2) 

2,2 dibromo pentane.

Numbering of Parent carbon chain is done considering lowest locant rule

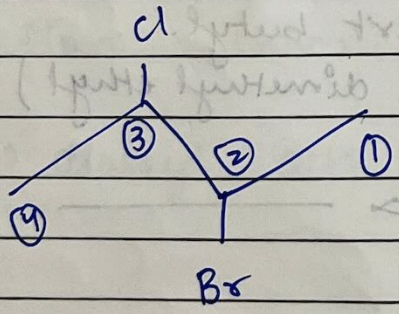
(3) 

2 - Bromo 2 chloro pentane.

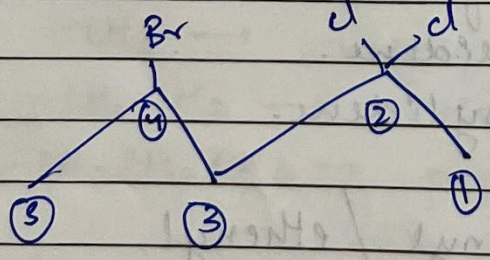
☆ Alphabetical order. for writing

-F, -Cl, -Br, -I, $-NO_2$, -NO, $-N_2$, -OR + etc.

for numbering also. (due to symmetry)

(4) 

2 Bromo 3 chloro butane.

(5) 

4-bromo - 2,2 dichloro pentane.

di, tri, tetra, ...

↳ not considered for Alphabetical order.

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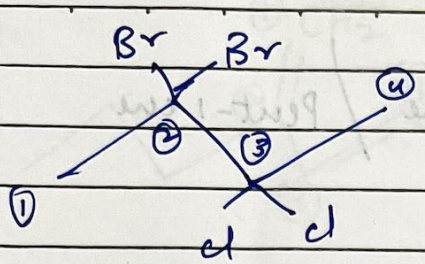
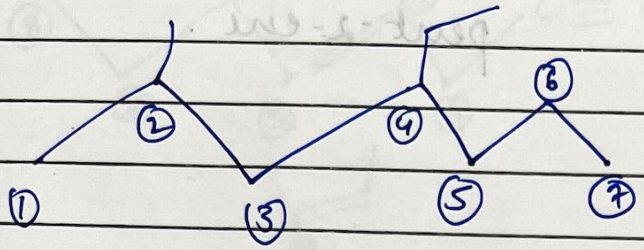
Date :

(6)



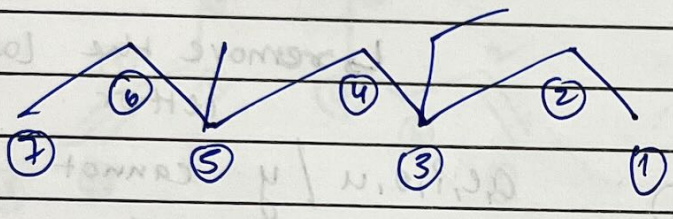
2,2 dibromo 3,3 dichloro butane.

(7)



4 ethyl 2 methyl Heptane.

(8)



3 ethyl 5 methyl Heptane.

↓

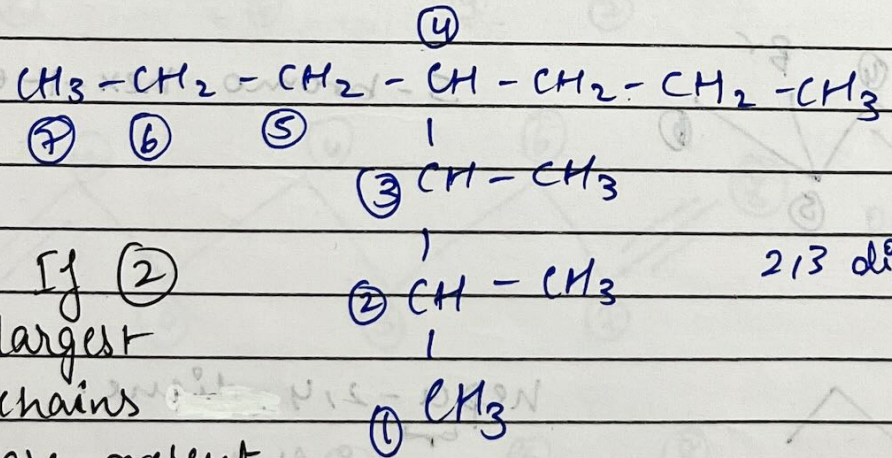
Alphabetical order.

↓

only because of symmetry

★ Functional group > = , ≡ > Substituent

(9)

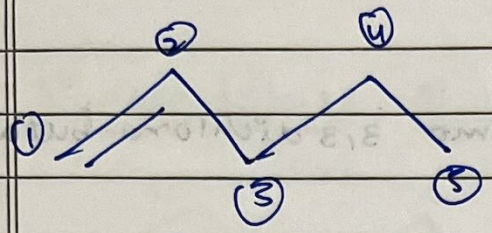


2,3 dimethyl 4-propyl Heptane.

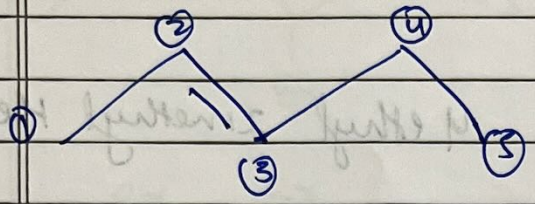
Rule: If (2) largest chains are present consider that chain with more substituents.

M T W T F S S

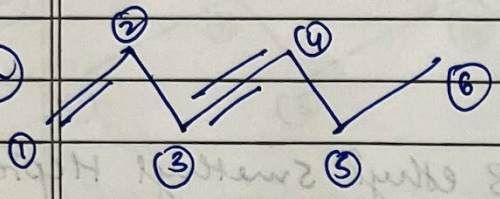
Date :

(10) 

Pentene / Pent-1-ene

(11) 

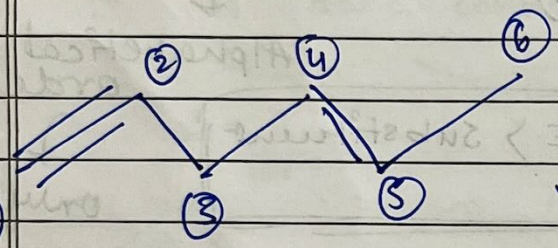
pent-2-ene.

(12) 

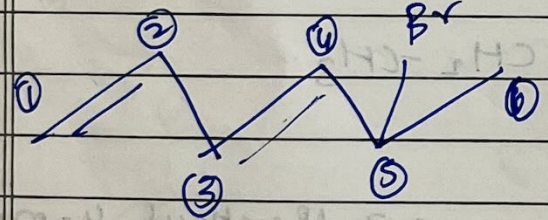
Hex-1-en-3-yne.

↳ remove the last letter.

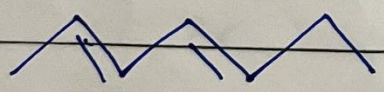
a, e, i, o, u / y cannot come together.

(13) 

→ hex-4-en-1-yne.

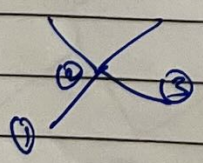
(14) 

5-bromo hex-1-ene.

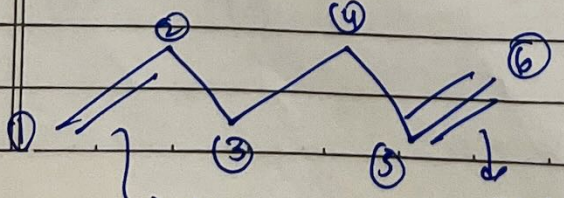
(15) 

hepa-2,4-diene.

↳ two similar bonds are there.

(16) 

2,2 dimethyl propane.

(17) 

hex-1-en-5-yne.

→ ene yne.

e > y. (alphabetical order)

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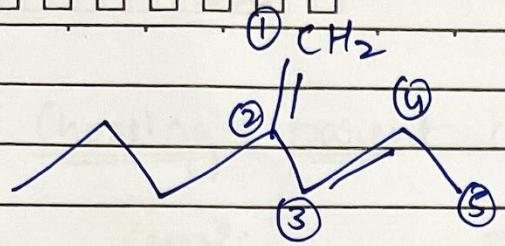
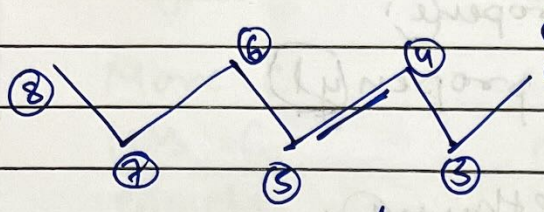
(18)



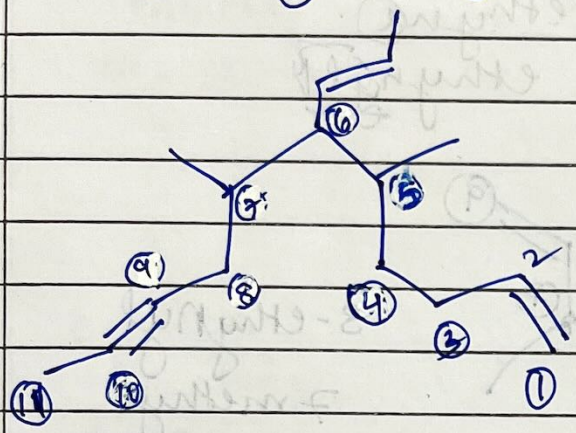
2-propyl penta-1,3 diene.

(19)



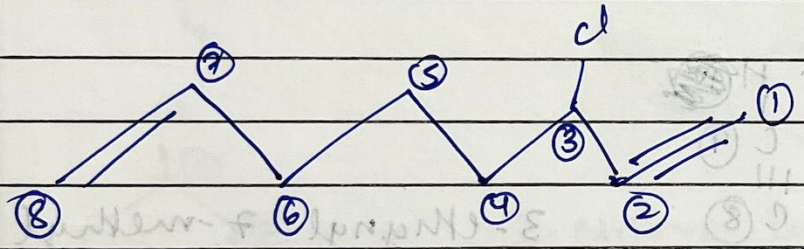
Oct-4-en-1 yne.

(20)



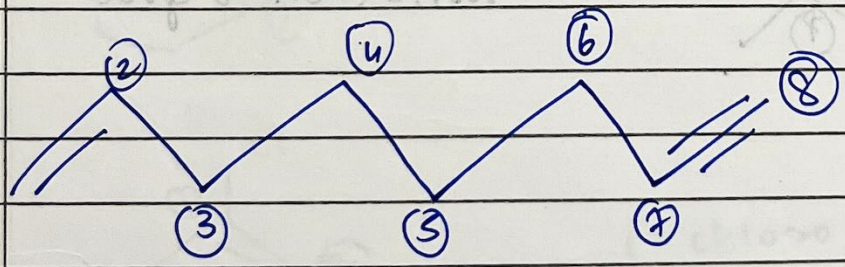
5,7 dimethyl 6-propenyl
Dec 1 en-9 yne.

(21)



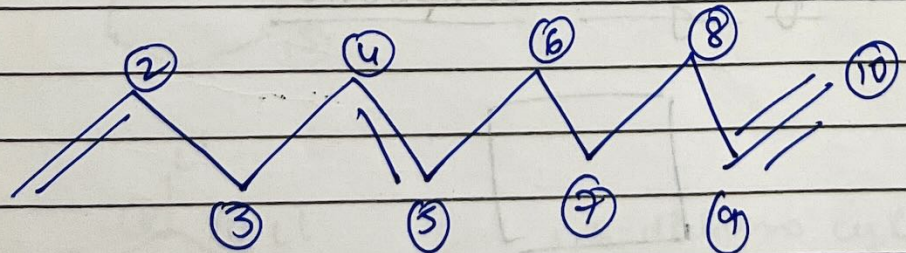
3-chloro
Oct-7-en-1 yne.

(1)



Oct-1-en-7yne.

(22)



Deca-1,4-dien-9-yne.

(22) ★ Methane → CH_4

Methyl → $-CH_3$

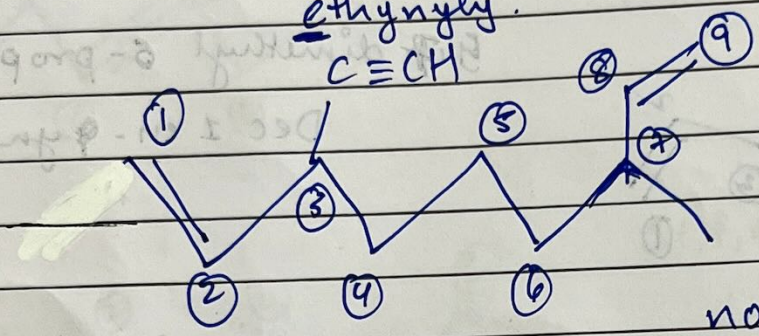
$CH_2 = CH - CH_3$ → propene

$CH_2 = CH - CH_2$ → propenyl

$CH \equiv CH$ → ethyne

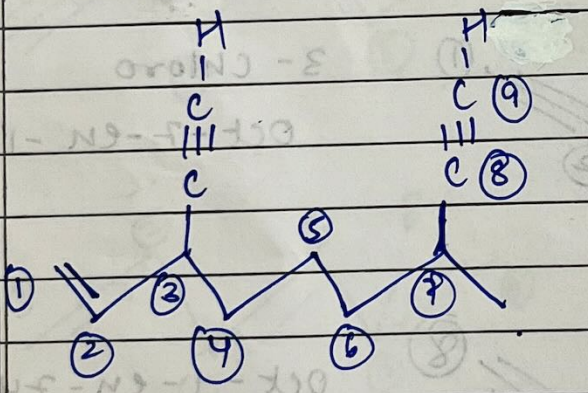
$CH \equiv C -$ → ethynyl

(23)



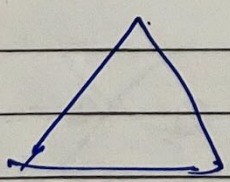
3-ethynyl 7-methyl nona-1,8-diene.

(24)

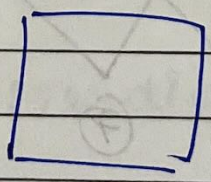


3-ethynyl 7-methyl non-1-en-8-yne.

Nomenclature of cyclic compounds



cyclo propane



cyclo butane.

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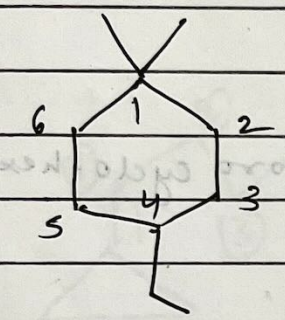
Date :

Choosing parent chain

Cyclic	Side chain	Parent chain
More C	less C	cyclic
less C	More C	side chain
equal C	equal C	cyclic
=, ≡	—	cyclic
—	=, ≡	side chain.

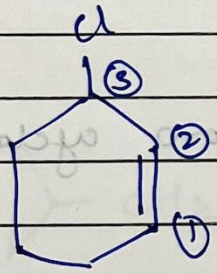
a)



4-ethyl, 1,1 dimethyl Hexane.

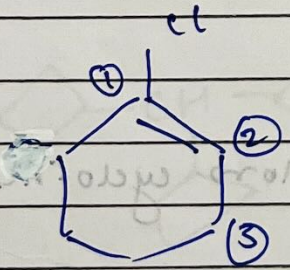
(more no. of substituents more priority)

(2)



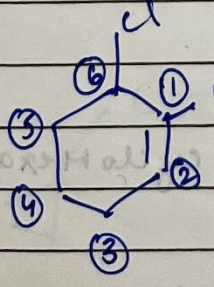
3-chloro cyclohex-1-ene.

(3)



1-chloro cyclohex-1-ene.

(4)



1,6 dichloro cyclohex-1-ene.

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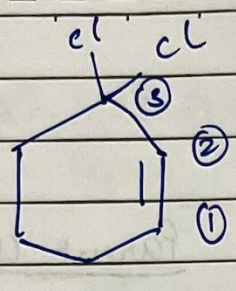
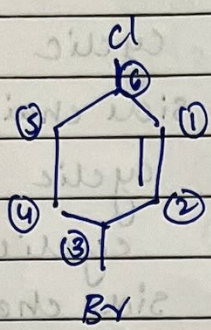
Date :

(5)



3,3 dichloro cyclohex-1-ene.

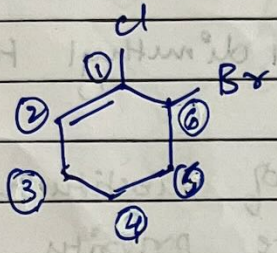
(6)



3-bromo-6-chloro cyclohex-1-ene.

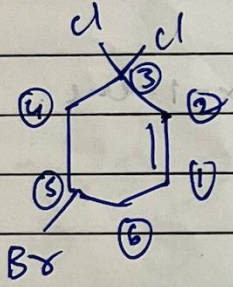
→ Alphabetical order.

(7)



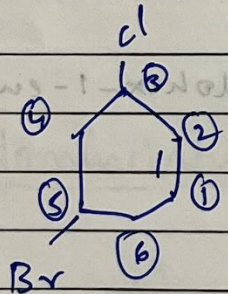
6-bromo-1-chloro cyclo-hex 1-ene.

(8)



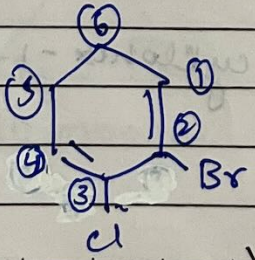
5-bromo-3,3 dichloro cyclohex-1 ene.

(9)



5-bromo-3chloro cyclo-hex 1-ene.

(10)



2-bromo 3-chloro cyclo Hexa 1,3 diene.

→ Double bonds must get less number.

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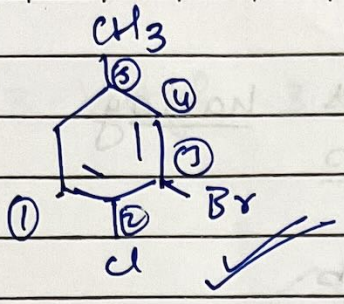
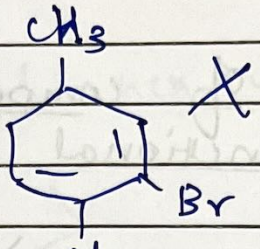
(11)





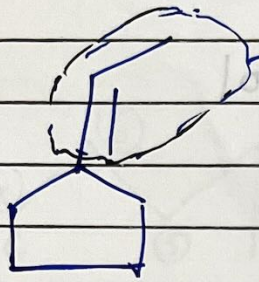
3- Bromo

2- chloro

5- methyl

cyclo Hexa-1,3 diene.

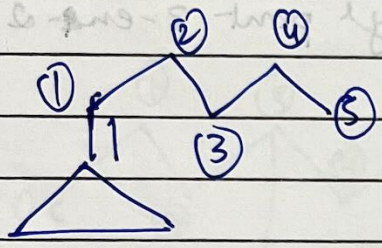
(12)



methylidene.

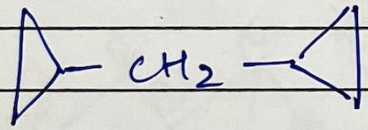
1 ethylidene cyclo pentane.

(13)



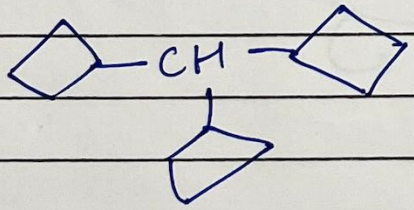
1- cyclo propylidene pentane.

(14)



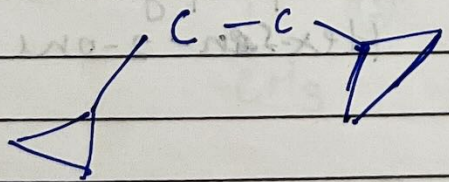
1,1 di cyclo propyl methane.

(15)



1,1,1 tricyclo butyl methane.

(16)



1,2- dicyclopropyl ethane.

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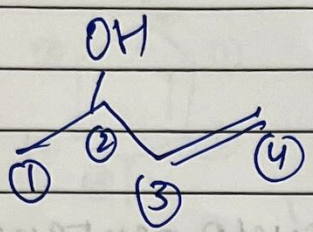
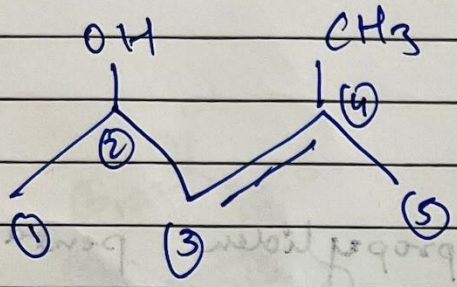
Date :

Nomenclature of compounds having functional group

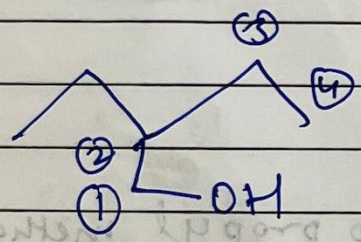
P.f.g > =, ≡ > sub.

(1) 

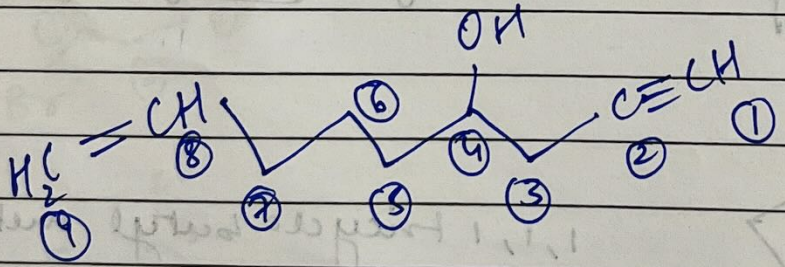
But-3-en-2ol

(2) 

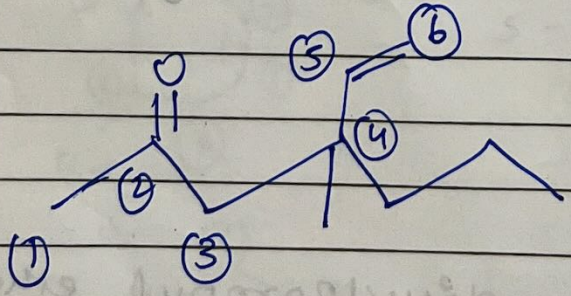
4-methyl pent 3-en-2 ol

(3) 

2-ethyl Butanol

(4) 

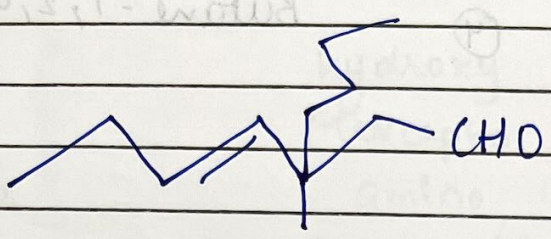
non-8-en-1-yn-4ol

(5) 

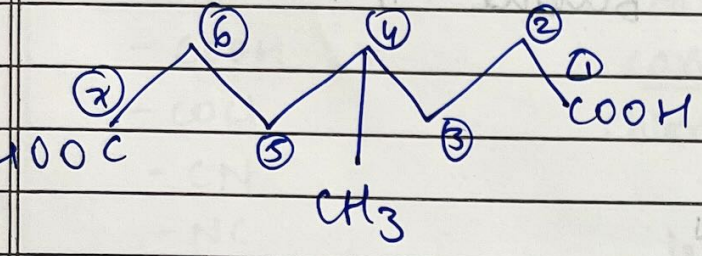
4-methyl
4-propyl
Hex-5-en-2-one

Date :

(6) 3-butyl - 3 methyl hex-4-en-1-al.

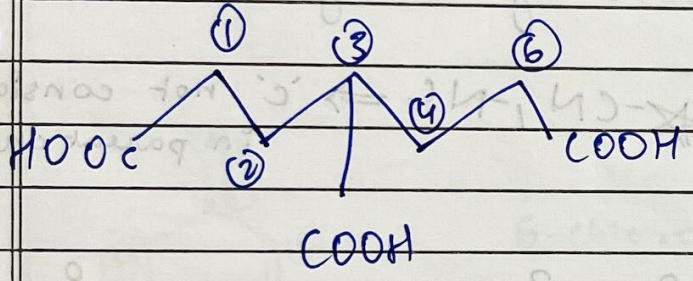


(7)



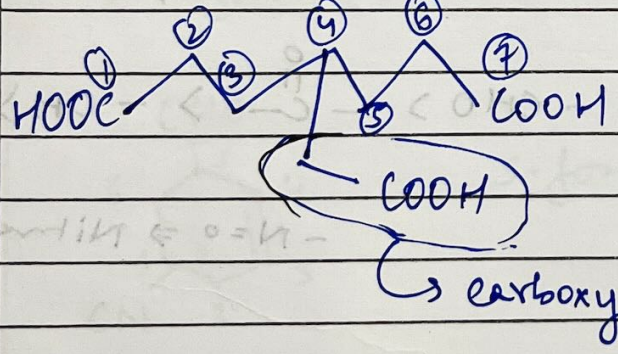
4-methyl hept-1,7 dioic acid.

(8)



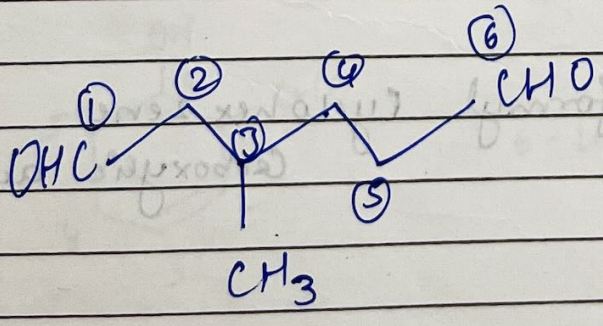
Pentane-1,3,5-tricarboylic acid

(9)



4-carboxymethyl hept-1,7 dioic acid.

(10)



3-methyl hexane 1,6 dial.

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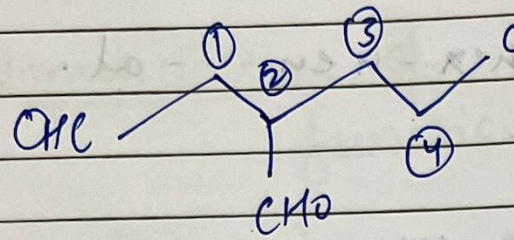
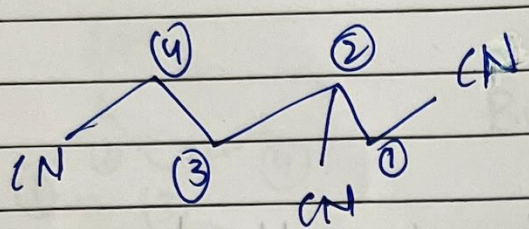
(11)



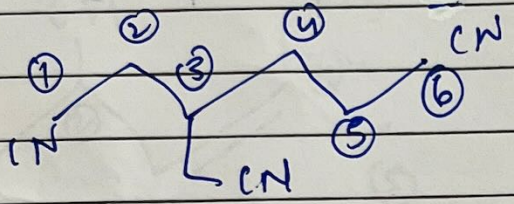
Butane - 1, 2, 4 tri carbaldehyde

(12)



Butane - 1, 2, 4 tri carbonitrile.

(13)



3- cyno methyl Hexa 1, 6 di nitrile.

✗ -CN, -NC ⇒ 'C' not considered in parent chain.

Priority order

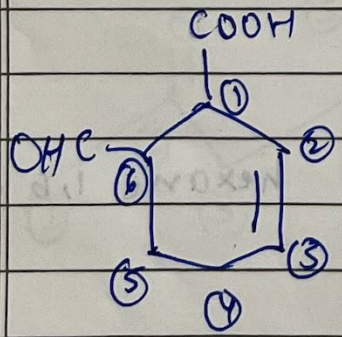
$$-COOH > -SO_3H > -\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}- > -COOR > -\overset{O}{\overset{\|}{C}}-Cl >$$

$$-\overset{O}{\overset{\|}{C}}-NH_2 > -CN > -CHO > -\overset{O}{\overset{\|}{C}}- > -OH >$$

$$-SH > -NH_2$$

$-N=O \Rightarrow$ Nitroso

(1)



6 formyl Cyclohex 2ene Carboxylic acid

In Ring :- $-COOH$ → carboxylic acid
$-CONH_2$ → carboxamide
$-CHO$ → carbaldehyde

$-\overset{O}{\overset{\|}{C}}-Cl$ → carbonyl chloride
$-CN$ → carbonitrile
$-SO_3H$ → sulphonic acid
$-NC$ → Isonitrile
$-NH_2$ → cyclo alkanamine.

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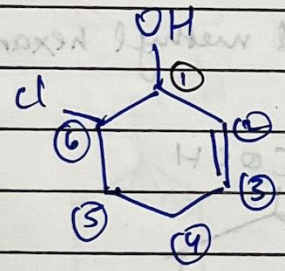
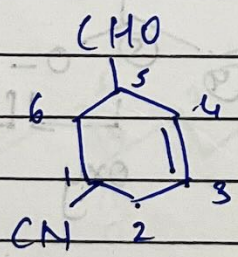
Functional group		as side chain	as functional group
(Alcohol)	$-OH$	hydroxy	ol
(Thio Alcohol)	$-SH$	Mercapto	thiol
(amine)	$-NH_2$	amino	Amine
	$-CHO$	formyl / oxo	-al
	$-\overset{O}{\overset{\|}{C}}-$	keto / oxo	-one
	$-COOH$	carboxy	-oic acid
	$-COCl$	Chloro carbonyl	-oyl halide
	$-CN$	cyano	nitrile
	$-NC$	isocyano	isonitrile
(amide)	$-CONH_2$	Carbamoyl	Amide

(2)



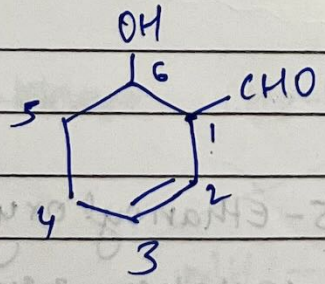
6-Chloro cyclo hex-2-en 1-ol

(3)



5-formyl cyclohex-3ene carbonitrile.

(4)



6-hydroxy cyclohex-3ene carbaldehyde.

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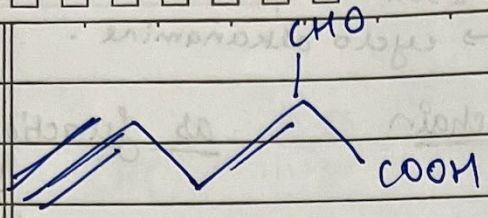
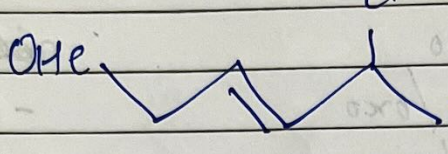
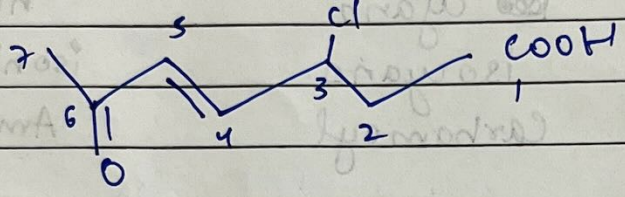
(5) 

→ 2 formyl pent-2en-4oic acid

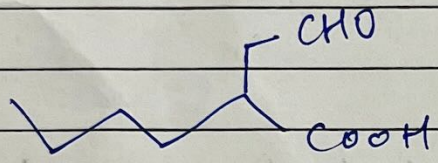
(6) 

2-chloro 6-oxo hex-2en oic acid

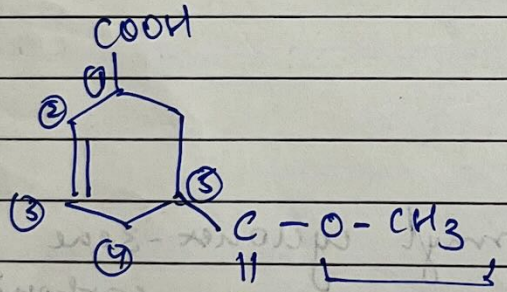
for aldehydic & ketonic group, oxo is used when their carbon is counted in the parent chain.

(7) 

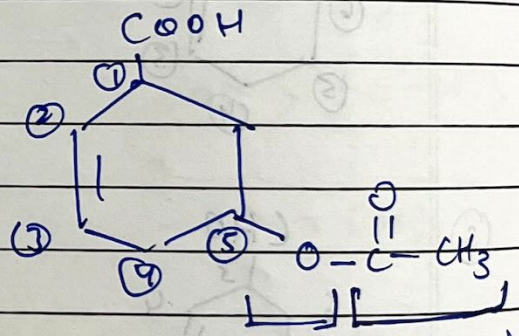
3-chloro 6-oxo Hept-4en-oic acid.

(8) 

2-formyl methyl hexanoic acid

(9) 

write this first



this first.

5-Methoxy carbonyl cyclo Hex-2ene carboxylic acid

5-Ethanoyl oxy cyclohex-2ene carboxylic acid.

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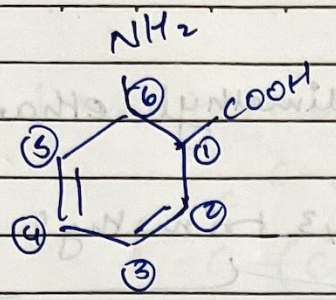
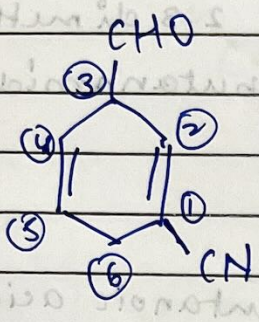
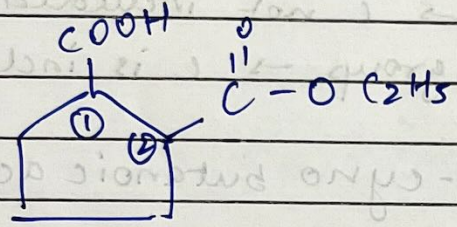
(10) 

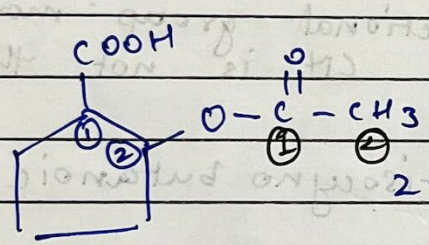
6-amino cyclo Hexa 2,4 diene carboxylic acid.

(11) 

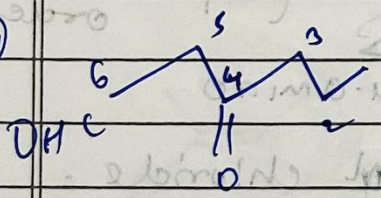
3-formyl cyclo Hexal,4diene carbonitrile.

(12) 

Ethoxy carbonyl cyclopentane carboxylic acid.

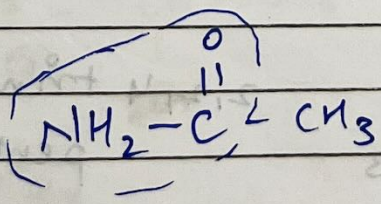
(13) 

2-ethanoyl oxy cyclopentane carboxylic acid.

(14) 

4,6 dioxo hexanoic acid.

(15) ~~[illegible]~~ $CH_3-NH-CHO$



N-methyl methanamide.

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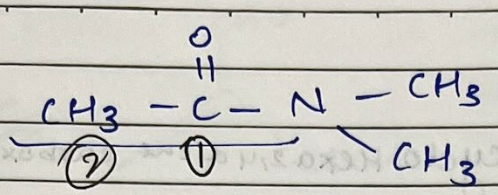
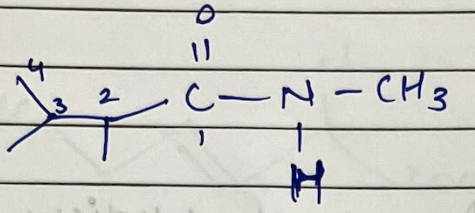
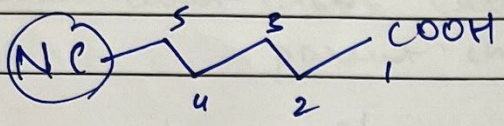
(16) 

(a) N,N-dimethyl ethanamide.

(b) N,2,3 trimethyl butanamide

(17) 

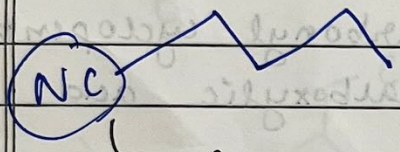
N-methyl 2,3 dimethyl butanamide.

(18) 

5-cyno pentanoic acid.

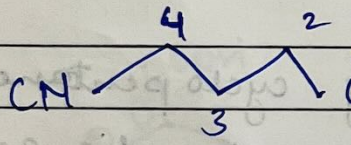
(19) ✱ CN as substituent → C not included

CN as functional groups → C is included.

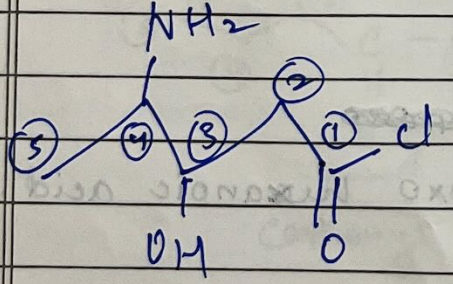


4-cyno butanoic acid

↳ include 'C' if functional group more prior than CN is not their

(20) 

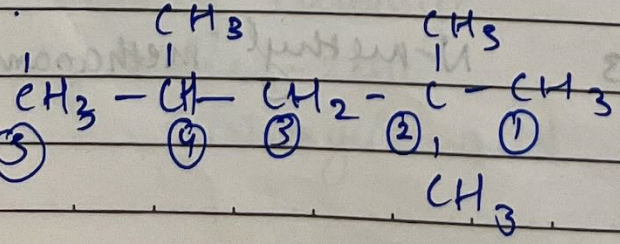
4-isocyno butanoic acid.

(21) 

(alphabetical order)

3-hydroxy 4-amino petanyl chloride.

(22) $(CH_3)_2 HC CH_2 C(CH_3)_3$



2,2,4 trimethyl pentane.

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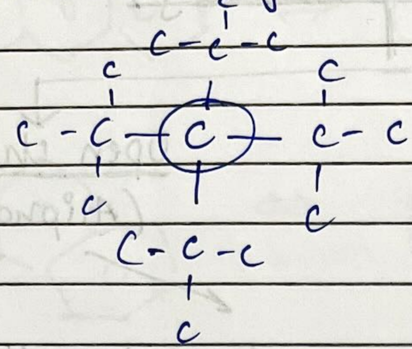
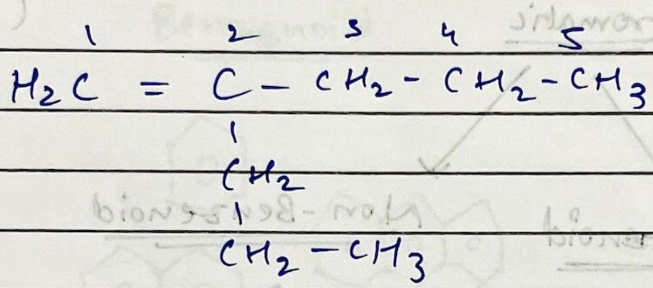
(23) tetra tert-butyl methane.

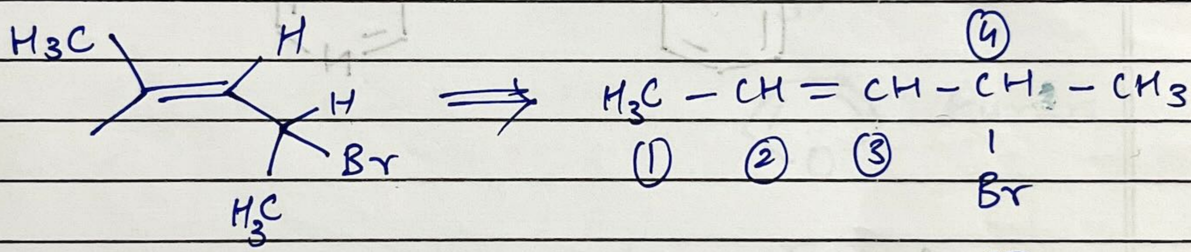


(24)

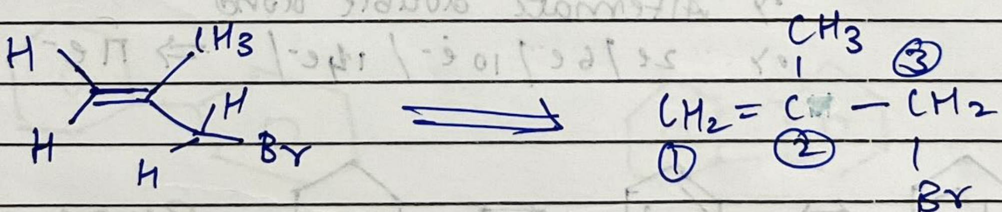


2-propyl pentene.

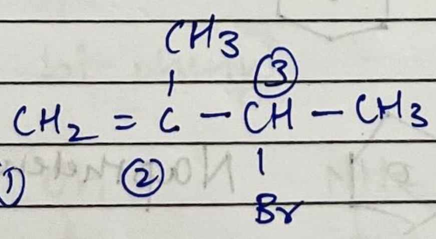
(25)



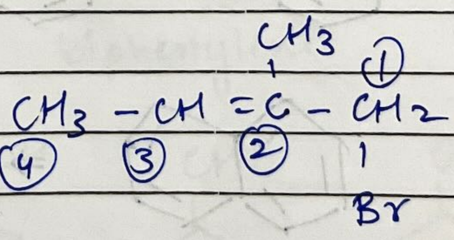
(4)



(3)



(3)



(1)

Sum of locant of Br : 4+3+3+1 ⇒ 11

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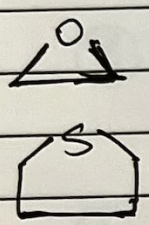
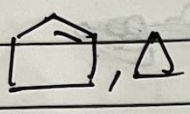
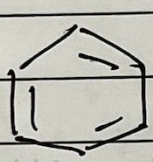
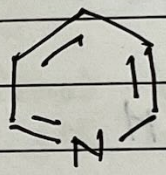
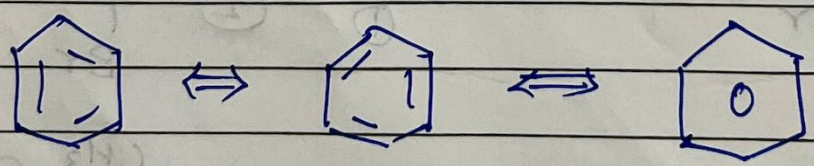
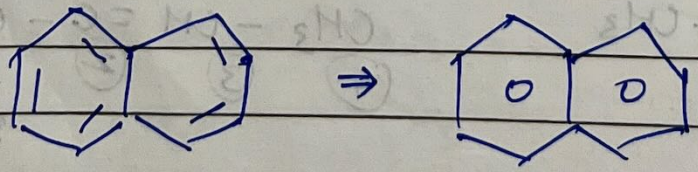
Organic Chemistry

- Cyclic
  - Heterocyclic
    - 
  - Homocyclic
    - Alicyclic
      - 
    - Aromatic
      - Benzenoid
        - 
      - Non-Benzenoid
        - 
- Open chain (Aliphatic)
  - Saturated (C-C)
  - Unsaturated
    - (C=C)
    - (C≡C)

Aromatic : ✓ cyclic
✓ Alternate double bond
✓ 2e / 6e / 10 e⁻ / 14e⁻ / ⇒ π e⁻



Benzene.



Napthelene.

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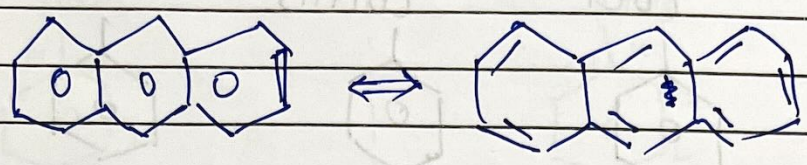
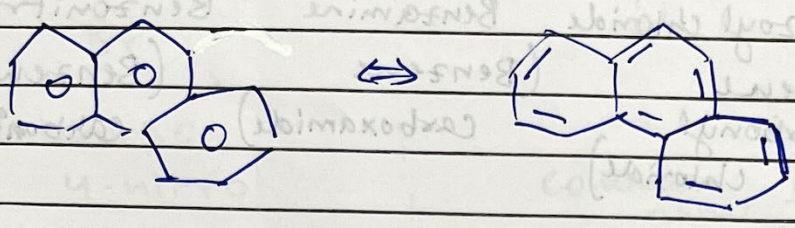
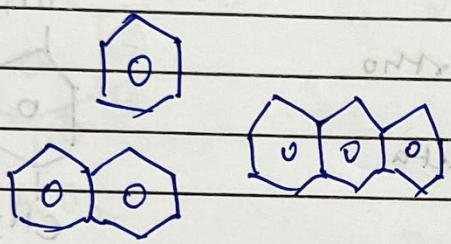
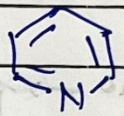
⇒  Anthracene.

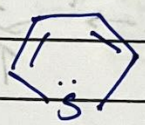
⇒  phenanthrecene.

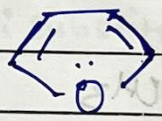
Benzenoid



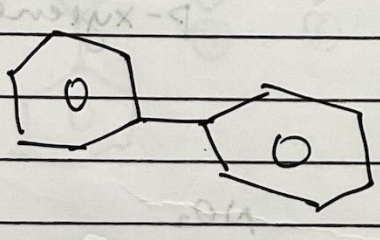
Non-Benzenoid

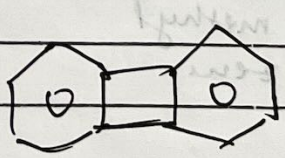
 Pyridine.

 Thiophene.

 Furan

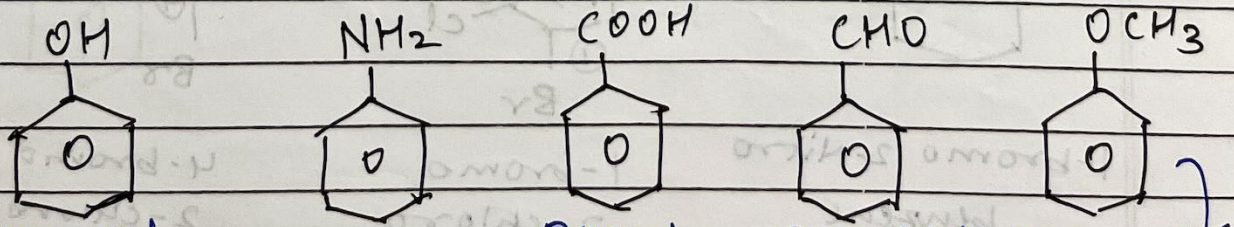
 Pyroll

\# 



bi-phenyl

biphenylene.

\# 

phenol

Aniline

Benzoic acid

Benzaldehyde

Anisole

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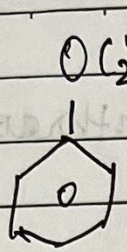
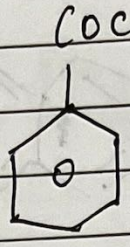
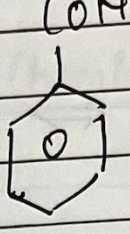
Date :



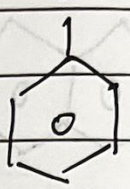
phenetole



Benzoyl chloride (Benzene carbonyl chloride)

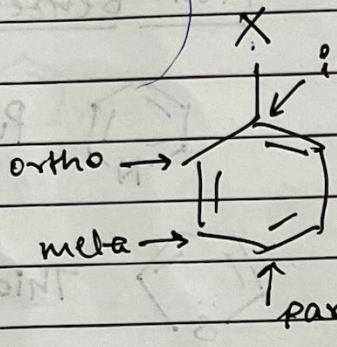


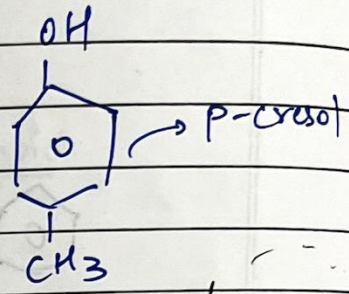
Benzamine (Benzene carboxamide)



Benzonitrile. (Benzene carbonitrile)

→ Name with O-, m-, p is a common name.





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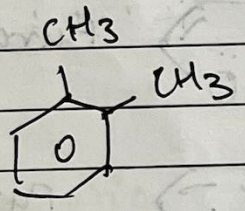
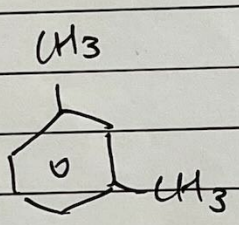
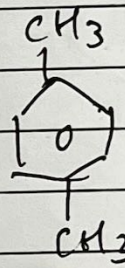


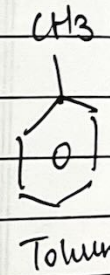
O-xylene



m-xylene



p-xylene.

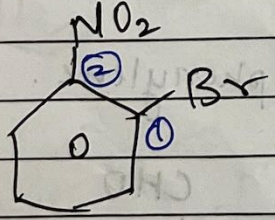


Toluene

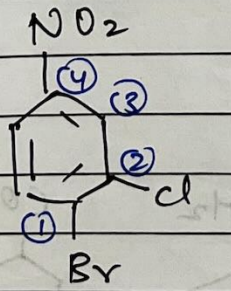
IUPAC : 1,2 di methyl Benzene

Xylene

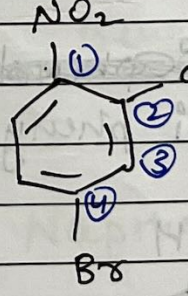
#



1-bromo 2-Nitro benzene



1-bromo 2-chloro 4-nitro benzene



4-bromo 2-chloro 1-nitro Benzene.

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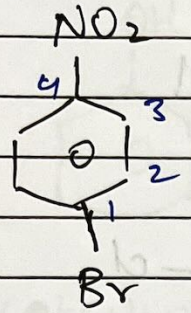
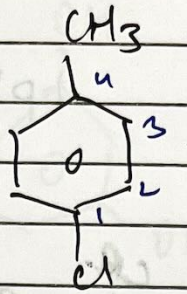
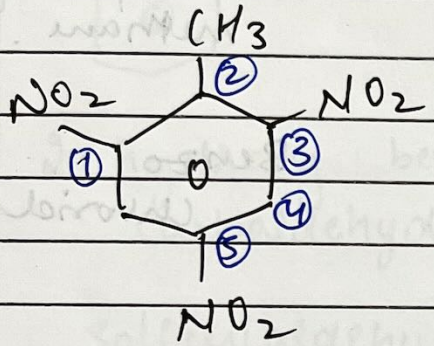


1-bromo
4-nitro
benzene.



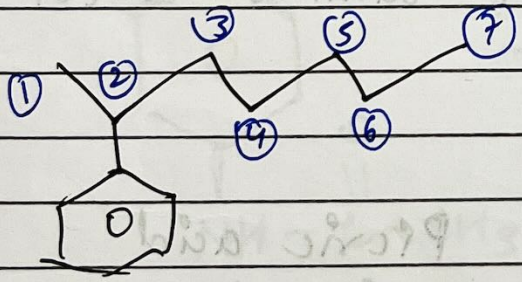
1-chloro
4-methyl
Benzene
(or)
4-chloro toluene.

common name → P-chloro toluene.

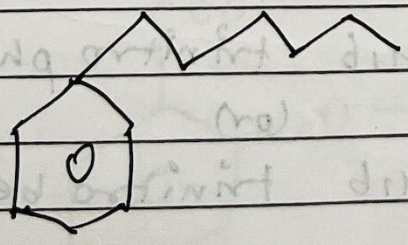


2 methyl - 1,3,5 trinitro benzene.
(or)
2,4,6 trinitro benzene.

★ KIM : O,p,m used for di substituted benzene rings only.



2-phenyl heptane.



hexyl benzene.

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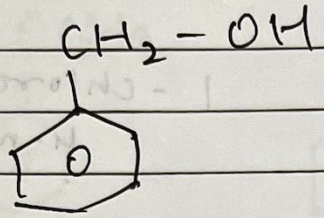
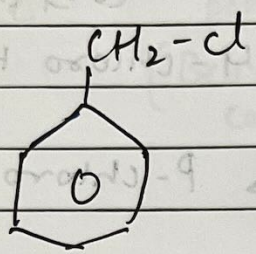
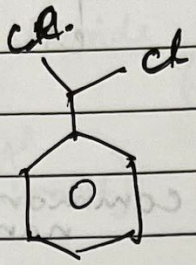
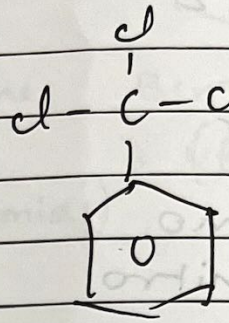


Phenyl methanol

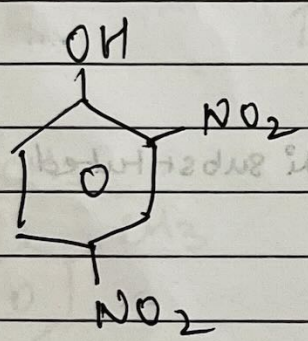






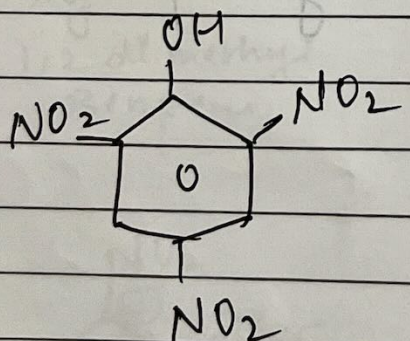
	Chloro phenyl Methane	dichloro phenyl Methane	trichloro phenyl methane.
C.N :	Benzyl chloride	Benzal chloride	Benzo chloride

#



2,4 dinitro phenol
(or)
2,4 dinitro benzol

#



Picric acid
(TNP)

2,4,6 trinitro phenol
(or)
2,4,6 trinitro benzol

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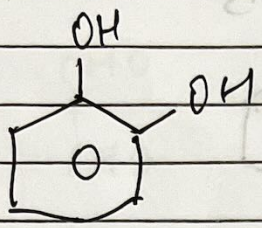
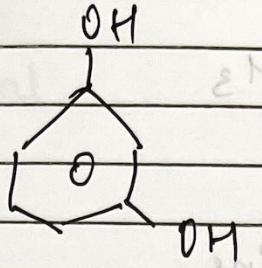
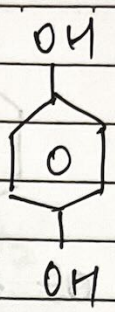


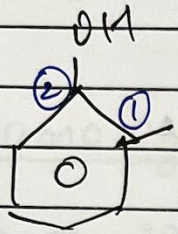
Catechol



Resorcinol

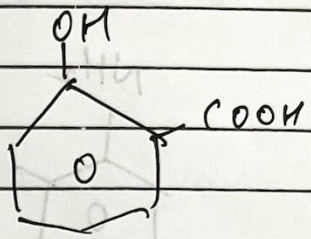


Quinol



2-hydroxy benzene carbaldehyde.

Salicylaldehyde.

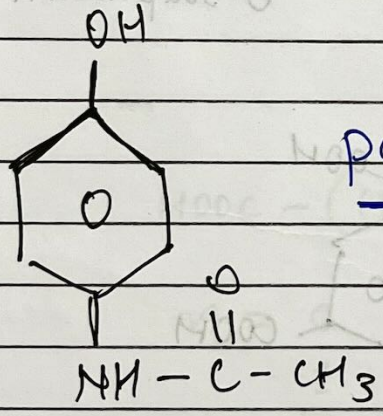


2-hydroxy benzene carboxylic acid.

Salicylic acid.

C.N

⇒

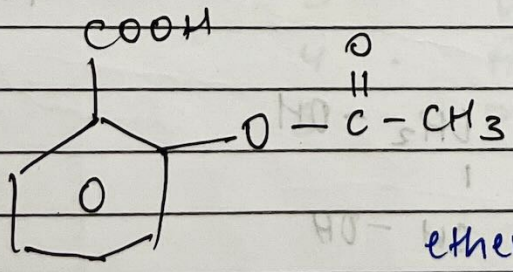


para - acetylamino phenol

— — O - —

PARACETAMOL.

⇒



ASPIRIN

ethenoyl oxy benzoic acid.

(or)

2-Acetoxy benzoic acid.

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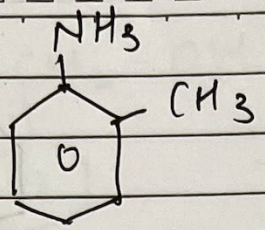
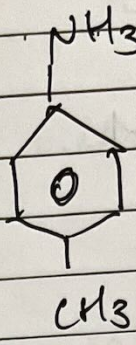
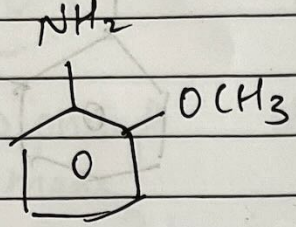
⇒ 

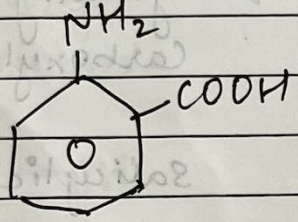
O - toluidine



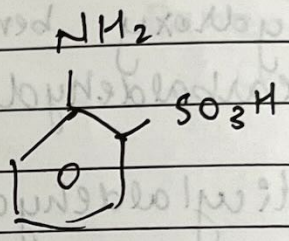
p - toluidine

⇒ 

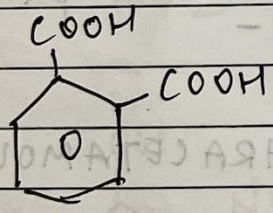
O - anisidine

⇒ 

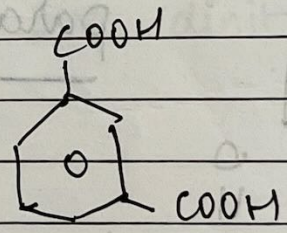
O - anthranilic



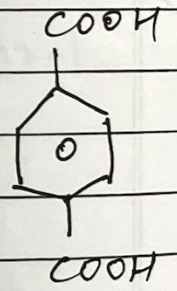
O - sulphanilic acid

⇒ 

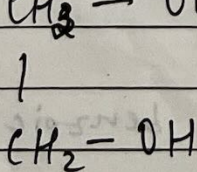
p - thalic acid



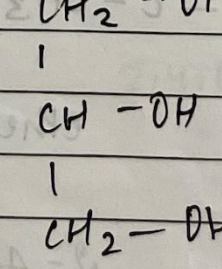
Iso-pathalic acid



Teripthalicacid

⇒ 

ethylene glycol



Glycerol / Glycerine.

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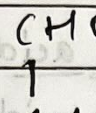
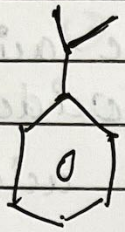
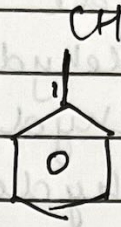


Glyoxal



cumene

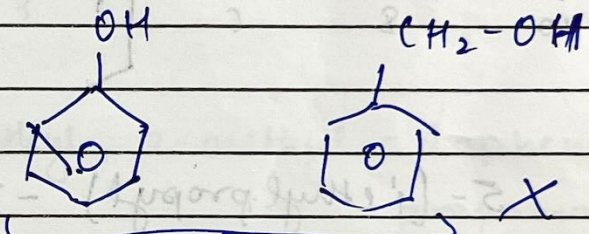


Styrene.

Homologus series

from same series / family differ by $-CH_2$ group. i.e 14 amu.

CH_4
C_2H_6 } $-CH_2$
C_3H_8 } $-CH_2$



should be from same family.

$HOOC-(CH_2)_n-COOH$

$n = 0$ - Oxallic acid
1 - Malonic acid
2 - Succinic
3 - Glutaric
4 - Adipic
5 - Pimelic

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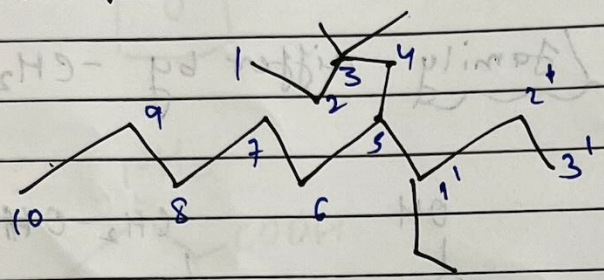
	Aldehyde	Carboxylic acid
$HCHO$	Formaldehyde	Formic acid
CH_3-CHO	Acetyldehyde	Acetic acid
C_2H_5-CHO	Propionaldehyde	Propionic acid
C_3H_7CHO	Butyraldehyde	Butyric acid
C_4H_9CHO	Valeraldehyde.	valeric acid.

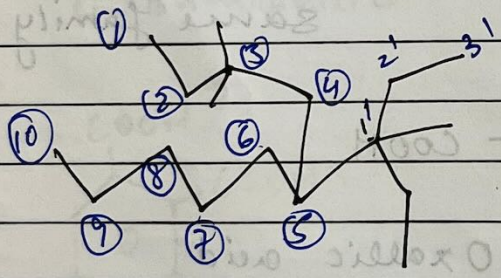
Complex branching

(1)



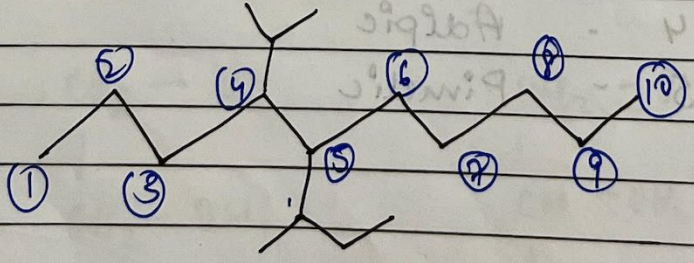
5-(1'ethylpropyl) -3,3 dimethyl Decane.

(2)



5-(1'methy ethyl propyl) -3,3 dimethyl decane.

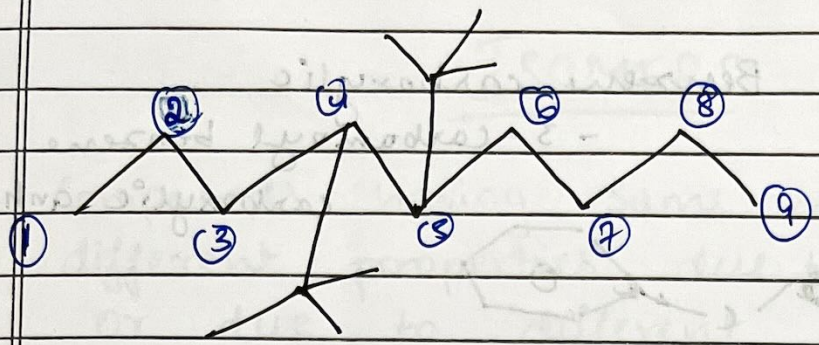
(3)



★ sec, tert
↳ Alphabetical order ✗

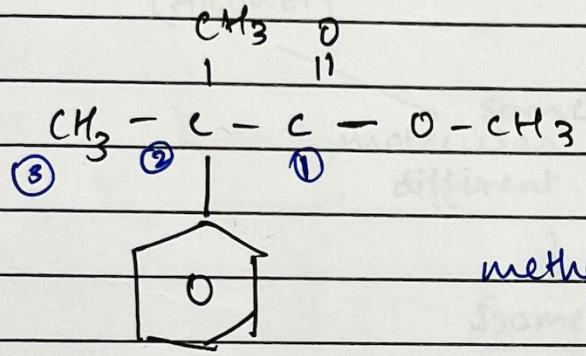
4-isopropyl 5-secbutyl Decane

★ iso, neo
↳ Alphabetical order ✓

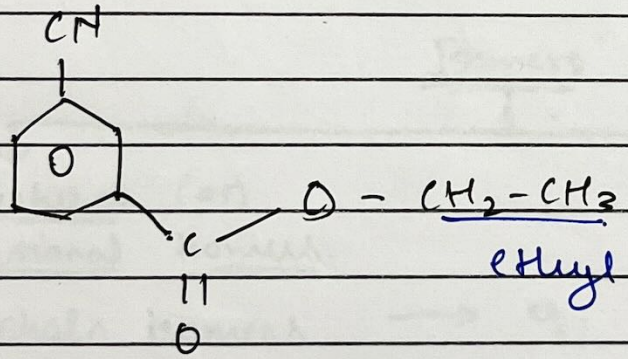


4,5 - bis - (1',1' - dimethyl ethyl) nonane.

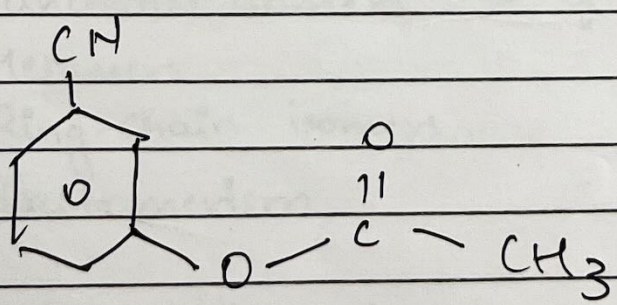
Q)



methyl, 2-methyl - 2-phenyl propanoate.



ethyl 3-cynobenzene carboxylate



3-cyanophenyl ethanoate.

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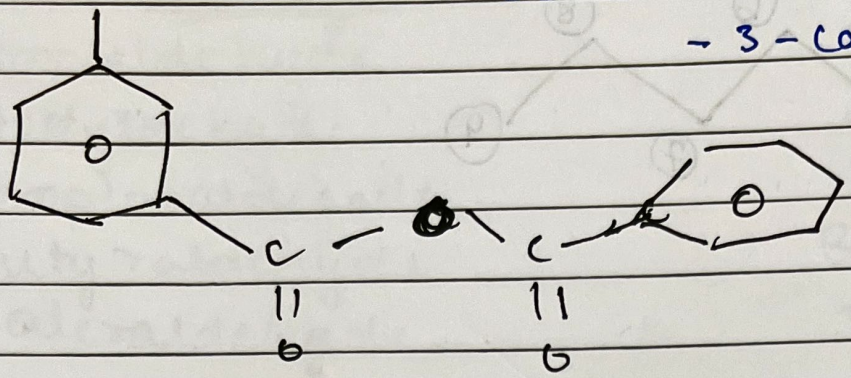

Benzene carboxylic
- 3 - carbamoyl benzene
carboxylic anhydride