ULTIMATE KCET

CRASH COURSE 2026

Chemistry | Lecture - 01

General organic chemistry

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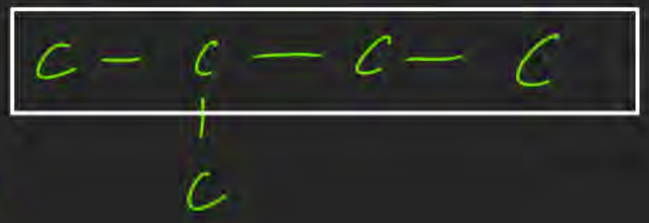
Recap *of previous lecture*

1. Mole concept ✓
2. Empirical formula and molecular formula ✓
3. Limiting reagent ✓

Topics *to be covered*

1. IUPAC nomenclature
2. Reactive intermediates
3. Isomerism
4. MCQ'S

Format for IUPAC name



4C → but

s – prefix	+	p – prefix	+	word root	+	p – suffix	+	s – suffix
Substituents with locants		cyclo		Alk word according to carbon in parent C chain		– ane (C–C) – ene (C=C) – yne (C≡C)		According to main functional group given in priority table

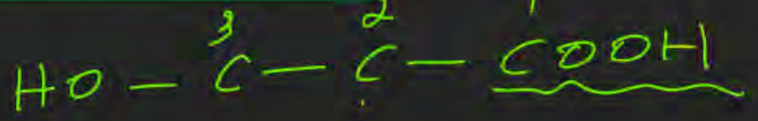
C_2H_5- CH_3 NO_2

Cl
Br
I

(a) Locant : Locants are link by (,) comma.

- Locants and alphabets are separated by hyphen (–). [2, 3 – dimethyl pentane]
- di, tri, iso, neo and cyclo are neither separated by comma nor by hyphen

Priority order of functional group



The order of decreasing priority for some functional groups is:

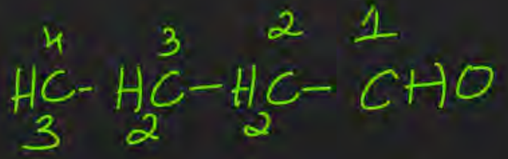
-COOH, $-SO_3H$, -COOR (R=alkyl group), COCl, $-CONH_2$, -CN, -HC =O, >C=O, -OH, $-NH_2$, >C=C<, $-C\equiv C-$

Priority order of functional group from high to low [in words]:

Carboxylic acids>Sulphonic acids>Acid halide>Acid amide>Nitrile or cyanide>Aldehyde>Ketone>Hydroxyl>Amine>double bond>Tripple bond.

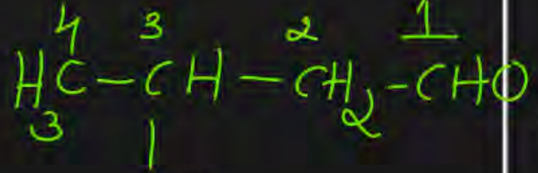
low priority → high priority

Class of compounds	Functional group structure	IUPAC group prefix	IUPAC group suffix	Example
Alkanes	-	-	-ane	Butane, $CH_3(CH_2)_2CH_3$
Alkenes	>C=C<	-	-ene	But-1-ene, $CH_2=CHCH_2CH_3$
Alkynes	-C≡C-	-	-yne	But-1-yne, $CH\equiv CCH_2CH_3$
Arenes	-	-	-	Benzene, 
Halides	-X (X=F,Cl,Br,I)	halo-	-	1-Bromobutane, $CH_3(CH_2)_2CH_2Br$
Alcohols	-OH	hydroxy-	-ol	Butan-2-ol, $CH_3CH_2CHOHCH_3$
Aldehydes	-CHO	formyl, or oxo	-al	Butanal, $CH_3(CH_2)_2CHO$
Ketones	>C=O	oxo-	-one	Butan-2-one, $CH_3CH_2COCH_3$



But+ane+al

Butanal



3-hydroxybutanal

		Low priority	high priority	
Nitriles	-C≡N	cyano	nitrile	Pentanenitrile, $CH_3CH_2CH_2CH_2CN$
Ethers	-R-O-R-	alkoxy-	-	Ethoxyethane, $CH_3CH_2OCH_2CH_3$
Carboxylic acids	-COOH	carboxy	-oic acid	Butanoic acid, $CH_3(CH_2)_2CO_2H$
Carboxylate ions	$-COO^-$	-	-oate	Sodium butanoate, $CH_3(CH_2)_2CO_2^-\ Na^+$
Esters	-COOR	alkoxycarbonyl	-oate	Methyl propanoate, $CH_3CH_2COOCH_3$
Acyl halides	-COX (X=F,Cl,Br,I)	halocarbonyl	-oyl halide	Butanoyl chloride, $CH_3(CH_2)_2COCl$
Amines	$-NH_2$, >NH,>N-	amino-	-amine	Butan -2-amine , $CH_3CHNH_2CH_2CH_3$
Amides	$-CONH_2$, -CONHR, $-CONR_2$	-carbamoyl	-amide	Butanamide, $CH_3(CH_2)_2CONH_2$
Nitro compounds	$-NO_2$	nitro	-	1-Nitrobutane, $CH_3(CH_2)_3NO_2$
Sulphonic acids	$-SO_3H$	sulpho	sulphonic acid	Methylsulphonic acid CH_3SO_3H

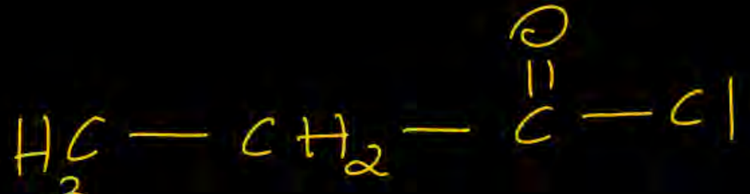
$H_3C-COOH$

Eth+ane+oic acid

H_3C-COO^-

Eth+ane+oate

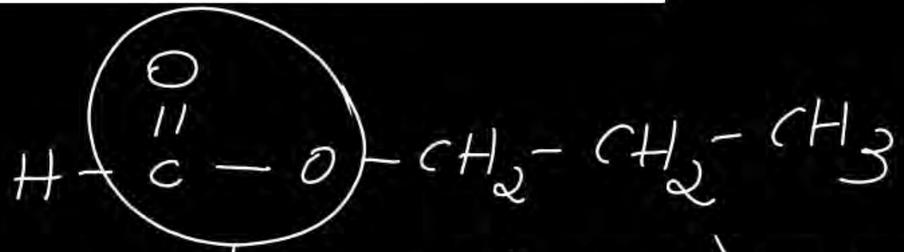
Ethanoate ion



prop + ane + oyl chloride

propanoyl chloride

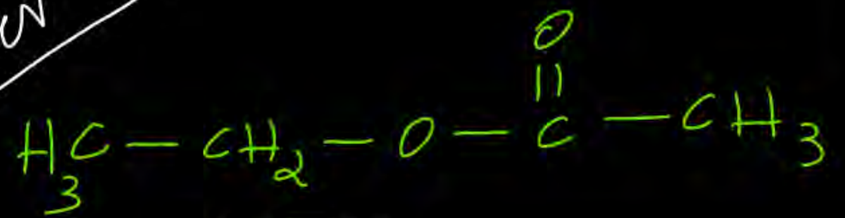
ester

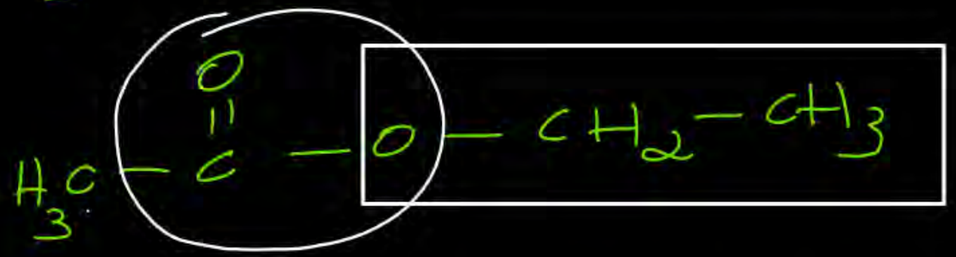


propyl meth + ane + oate

propylmethanoate.

ester





ethyl eth + ane + oate

ethyl ethanoate.

Prefix

There are two types of prefixes :

(i) **Primary prefix.** A primary prefix is used simply to distinguish cyclic from acyclic compounds.

(ii) **Secondary prefix.** In the IUPAC system of nomenclature, certain groups are not considered functional groups but instead are treated as substituents.

F NO_2 CH_3
Cl CH_3O C_2H_5
Br C_2H_3O
I

$H_3C-CH-CH_3$ } isopropylgroup.

prefix + wordroot + suffix

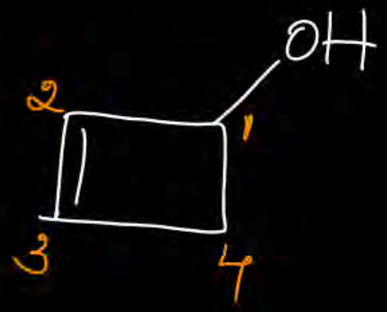
1° suffix: ane, ene, yne

2° suffix: functional Group

C-C C≡C
C=C

cyclo + prop + ane

cyclopropane



cyclo + but + 2-ene + 1-ol

i° suffix

cyclobut-2-ene-1-ol

i° prefix

word root

2° suffix

Prefix

Substituent group	Secondary group	Substituent group	Secondary prefix
$-F$	Fluoro	$-CH_3$ ($-Me$)	Methyl
$-Cl$	Chloro	$-C_2H_5$ ($-Et$)	Ethyl
$-Br$	Bromo	$-CH_2CH_2CH_3$ (*n*-Pr)	*n*-Propyl
$-I$	Iodo		
$-NO_2$	Nitro		
$-OR$	Alkoxy		
OCH_3	Methoxy		
OC_2H_5	Ethoxy		

Meth +

(c) **Word root :** According to number of carbons in parent C–chain.

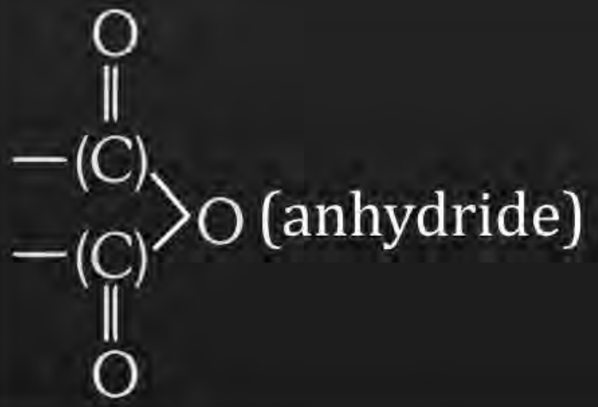
Number of carbons	Root word
1	Meth
2	Eth
3	Prop
4	But
5	Pent

Number of carbons	Root word
6	Hex
7	Hept
8	Oct
9	Non
10	Dec

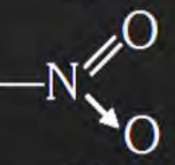
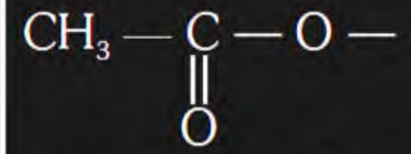
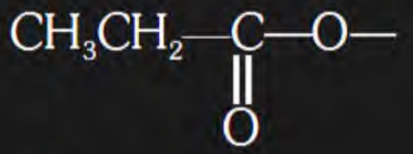
Number of carbons	Root word
11	Undec
12	dodec
13	tridec

(d) **Primary suffix :** According to saturation and unsaturation.

C – C → ane C = C → ene C ≡ C → yne

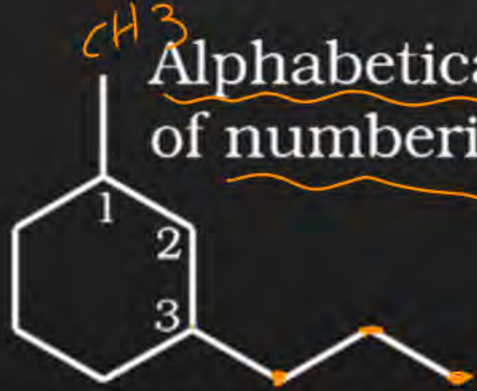
S. NO.	Functional group	Prefix	Suffix
1.	—(C)OOH (carboxylic acid)	×	oic acid
2.	—SO_3H (sulphonic acid)	sulpho	sulphonic acid
3.	 (anhydride)	×	oic anhydride
4.	—(C)OOR (ester) —COOR	× alkoxycarbonyl or carbalkoxy	alkyl ----- oate alkyl ----- carboxylate
5.	—(C)OX (acid halide) —COX	× Haloformyl	oyl halide carbonyl halide

6.	—(C)ONH$_2$ (amide) —CONH$_2$	× carbamoyl	amide Carboxamide
7.	—(C)N (cyanide) —CN	× Cyano	Nitrile carbonitrile
8.	— NC ≡ (isocyanide)	isocyano/ carbylamino	isonitrile/carbylamine
9.	—(C)HO (aldehyde) —CHO	oxo Formyl	al carbaldehyde
10.	— (C) — (Ketone) ‖ O	keto/oxo	one
11.	—OH (alcohol)	hydroxy	ol
12.	—SH (thio alcohol)	mercapto	thiol
13.	—NH$_2$ (amine)	amino	amine

SUBSTITUENTS	PREFIX	SUBSTITUENTS	PREFIX
— R	alkyl	— X	halo
— NH_2	amino		nitro
—O—N=O	nitrito	— N = O	nitroso
— OCH_2CH_3	ethoxy	— CH_2 – OH	hydroxymethyl
— CH_2—Cl	chloromethyl	— NH – CH_3	methylamino
— S —	thio		
	acetoxy/ethanoyloxy		propanoyloxy
	benzoyloxy	–OR	Alkoxy
		$–OC_6H_5$	Phenoxy

Cyclic compounds

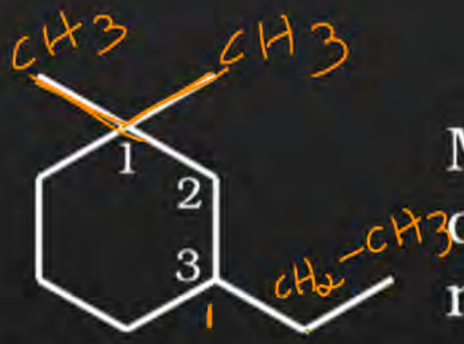
Cyclopentane :



Alphabetical order of numbering

: 1-Methyl-3-propylcyclohexane

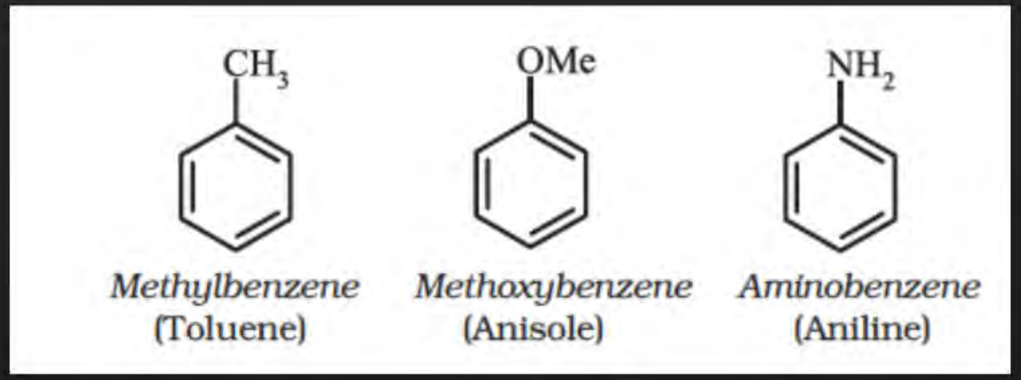
Cyclic compounds



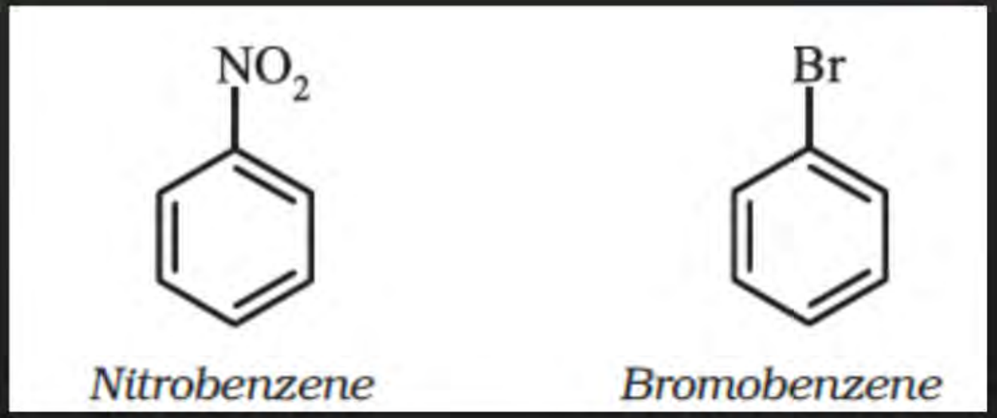
More branched carbon gets lower number

3-Ethyl-1,1-dimethylcyclohexane
(not 1-ethyl-3,3-dimethylcyclohexane)

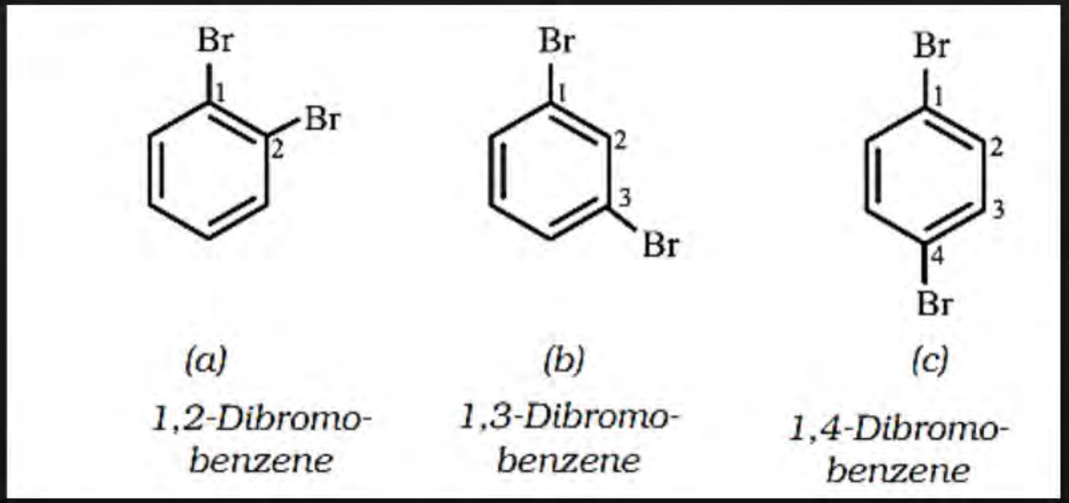
Aromatic compounds



Methylbenzene (Toluene) | *Methoxybenzene* (Anisole) | *Aminobenzene* (Aniline)



Nitrobenzene | *Bromobenzene*

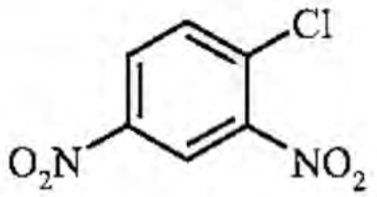


(a) *1,2-Dibromo-benzene* | *(b)* *1,3-Dibromo-benzene* | *(c)* *1,4-Dibromo-benzene*

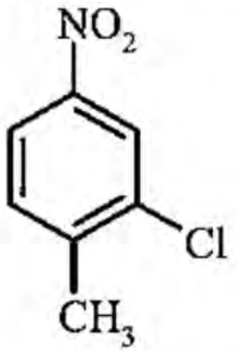
Aromatic compounds

NCERT Based

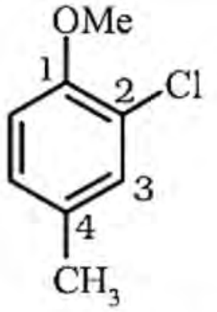
VIMP



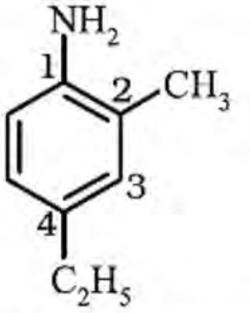
1-Chloro-2,4-dinitrobenzene
(not 4-chloro,1,3-dinitrobenzene)



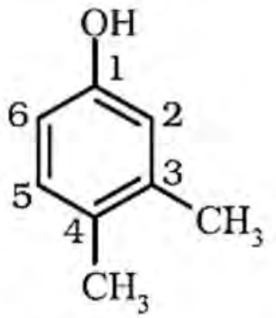
2-Chloro-1-methyl-4-nitrobenzene
(not 4-methyl-5-chloro-nitrobenzene)



2-Chloro-4-methylanisole



4-Ethyl-2-methylaniline



3,4-Dimethylphenol

Electrophile:

Electron poor species.

→ +vely charged Electrophiles

$H^{\oplus}$, $NO_2^{\oplus}$, $Cl^{\oplus}$, $Br^{\oplus}$, $CH_3^{\oplus}$, $CH_3-CH_2^{\oplus}$

→ Neutral electrophiles

$AlCl_3$, BF_3, BCl_3, SO_3

$FeCl_3$

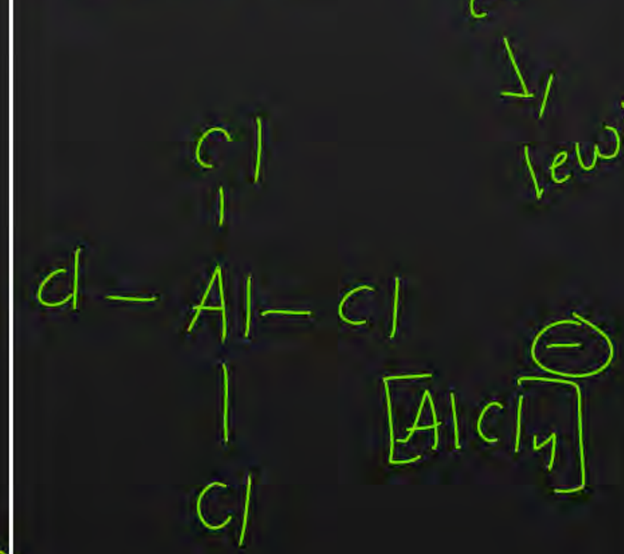
(lewis acids → accepts pair of electron)

Anhyd.

$Cl_2 + AlCl_3$

$Cl^{\oplus}-Cl^{\ominus}$

electrophile → lewis acid



(b) Nucleophilic reagent or nucleophiles

Electron rich species.

Which attacks on the positive site of the substrate or loves nucleus or having attraction towards nucleus.

Nucleophilic (Nucleo + philes)

↓

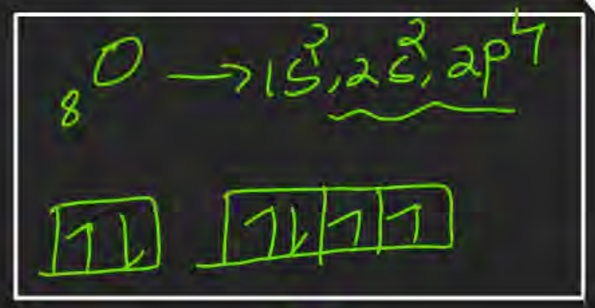
(Nucleus + loving)

Nucleophiles may be negatively charged ions or posses a lone pair of electron or πe^{-}.

- Nucleophiles can be considered as Lewis base.

(i) Negatively charged nucleophiles.

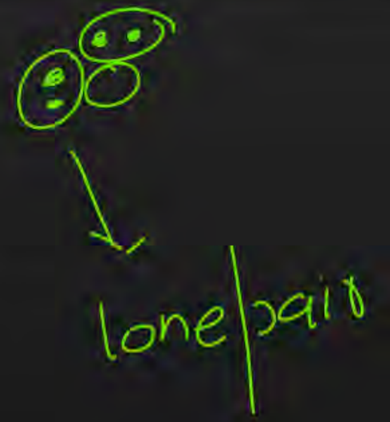
$\overset{\ominus}{H}$, $\overset{\ominus}{O}H$, $\overset{\ominus}{O}R$, $\overset{\ominus}{C}N$, $\overset{\ominus}{X}$, $\overset{\ominus}{R}$, $R-C(=O)\overset{\ominus}{O}$, $\overset{\ominus}{N}H_2$, $\overset{\ominus}{S}H$



(ii) Neutral nucleophiles :

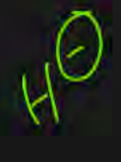
(a) Lone pair containing

$H_2\ddot{O}$, $R-\ddot{O}H$, $R-\ddot{O}-R$, $\ddot{N}H_3$, $R-\ddot{N}H_2$, $R_3\ddot{N}$

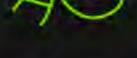


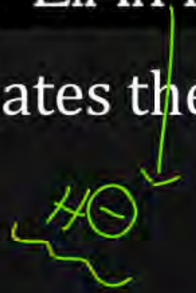
(b) πe^- containing

$CH_2=CH_2$, $CH\equiv CH$, 



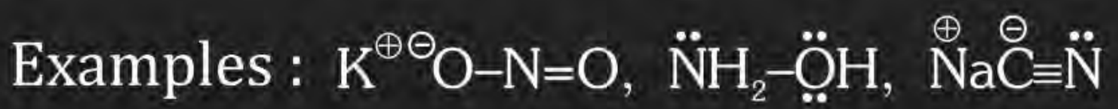
(iii) $\overset{*}{R}-Mg-X$, $LiAl\overset{*}{H}_4$, $NaB\overset{*}{H}_4$





The star (*) indicates the atom which donates electrons to the substrate.

Ambident nucleophile : Nucleophiles which have two sites of electron rich centre or in which two or more atoms bear a lone pair of electrons.

Examples : 

REACTION INTERMEDIATE

$-\overset{\oplus}{C}-$ ⟶ 6 $e^{\ominus}$ ⟶ s, p, p ⟶ sp^2

Carbocation : Cation in which positive charge is present on carbon atom is called carbocation.

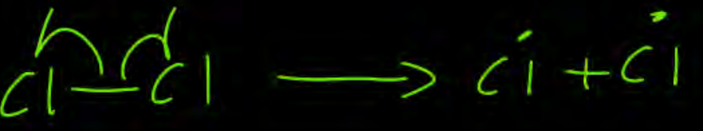
- Due to electron deficiency it acts as an electrophile and always attack on electron richer site.
- It is incomplete octet species because it has six electron in outer most shell.
- All electrons are paired.

⟶ planar trigonal

⟶ sp^2

⟶ 120° (bond angle)

Reactive intermediates.

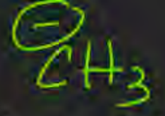


Homolytic fission

Methyl free radical

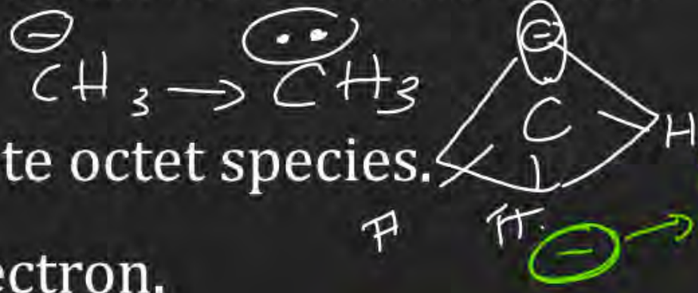
Heterolytic fission

- $-\overset{|}{C}-\overset{|}{C}- \longrightarrow$ σ bond
  - $\downarrow$
  - $s, p, p, p \rightarrow sp^3$
- $-C=C- \longrightarrow sp^2$
- $-C\equiv C- \rightarrow sp$

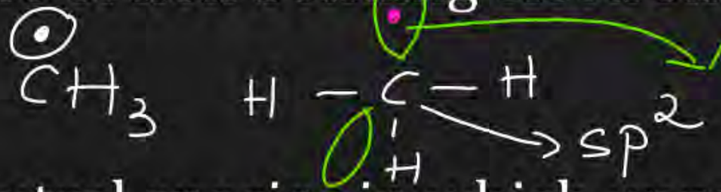


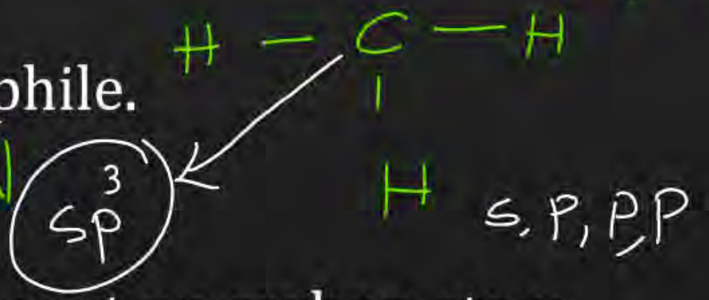
sp^3, tetrahedral, $109^\circ 28'$

Carbanions : Anion in which negative charge is present on carbon atom is called carbanion.



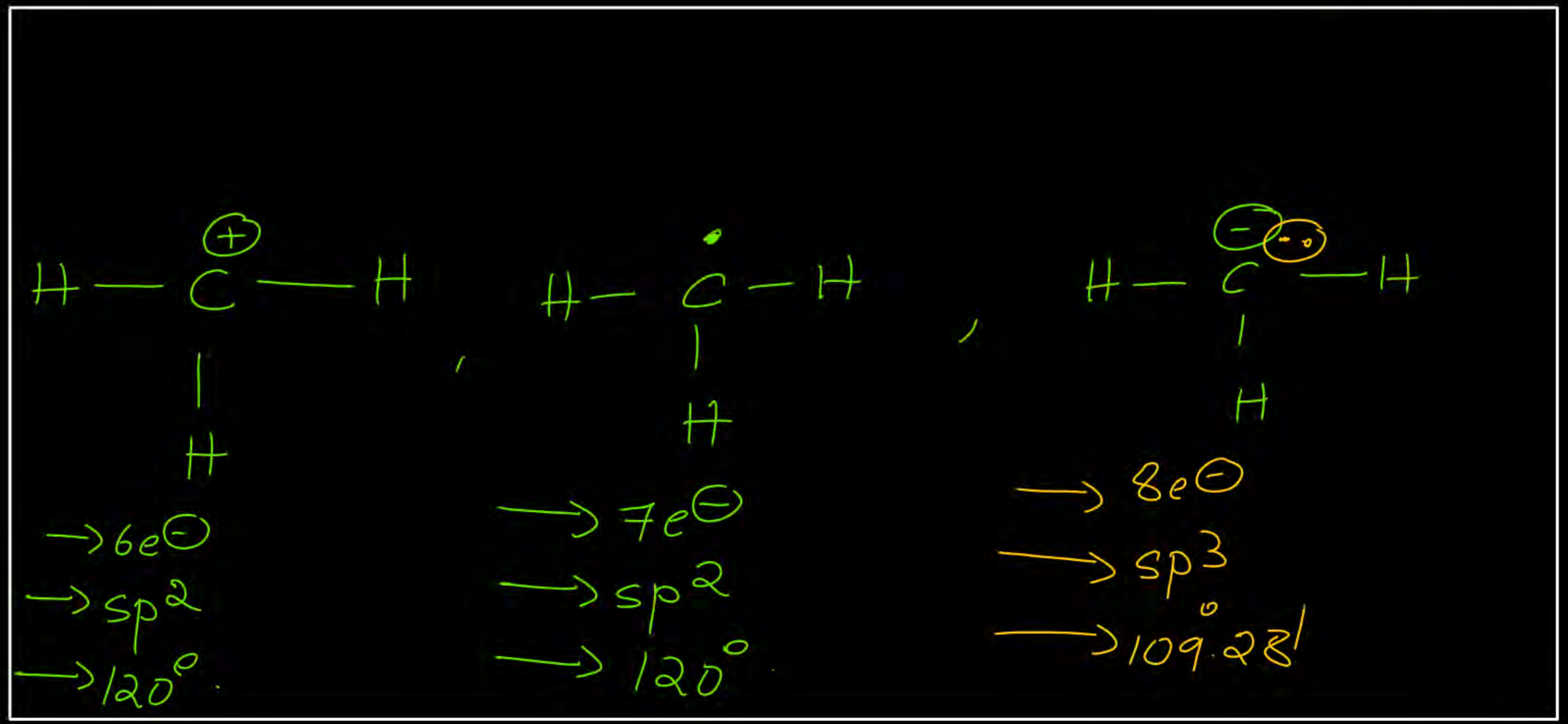
- It has eight electron in outermost shell so it is complete octet species.
- It is an electron richer species because it has extra electron.
- Due to presence of non bonding electrons it acts as a nucleophile.





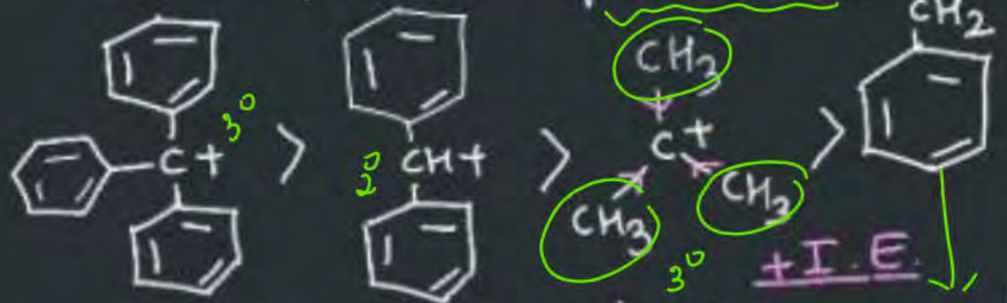
Free Radical :

- Electrically neutral species in which unpaired electron is present on carbon atom is known as carbon free radical.
- It has seven electron or odd electron in outermost shell of unpaired electron containing carbon.
- It is electron deficient species due to incomplete octet.


→ 6e⊖
→ sp²
→ 120°
→ 7e⊖
→ sp²
→ 120°
→ 8e⊖
→ sp³
→ 109.28°

Stability order of Carbocation $(C^{\oplus})$

$3^\circ > 2^\circ > 1^\circ$

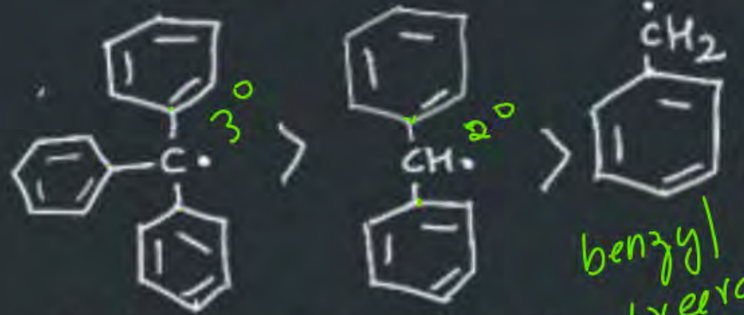


benzyl carbocation

$> CH_2=CH-\overset{+}{C}H_2$ Allyl cation $> CH_3-\overset{+}{C}H-CH_3$ (2°) $> CH_3-\overset{+}{C}H_2$ (1°) $> \overset{+}{C}H_3$

$> CH_2=\overset{+}{C}H$ → sp^2

Stability of free radical: $(C^{\bullet})$



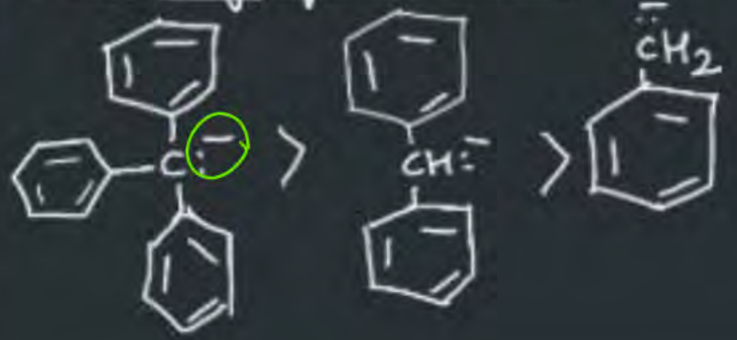
benzyl freeradical

$> CH_2=CH-\dot{C}H_2$ allyl freeradical $> CH_3-\dot{C}H-CH_3 > CH_3-\dot{C}H_2 > \dot{C}H_3$

$3^\circ > 2^\circ > 1^\circ$

$> CH_2=\dot{C}H$

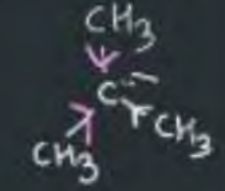
Stability of Carbanion $(C^{\ominus})$



$> CH_2=CH-\ddot{C}H_2 > CH_2=\ddot{C}H > \ddot{C}H_3 > CH_3-\ddot{C}H_2 > CH_3-\ddot{C}H-CH_3$

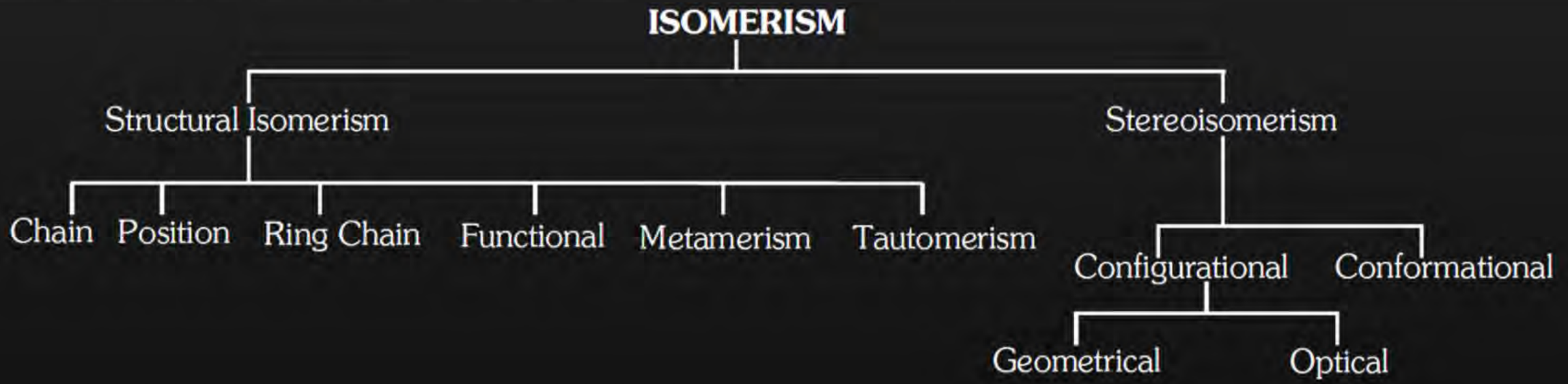
allyl carbanion

$1^\circ > 2^\circ > 3^\circ$

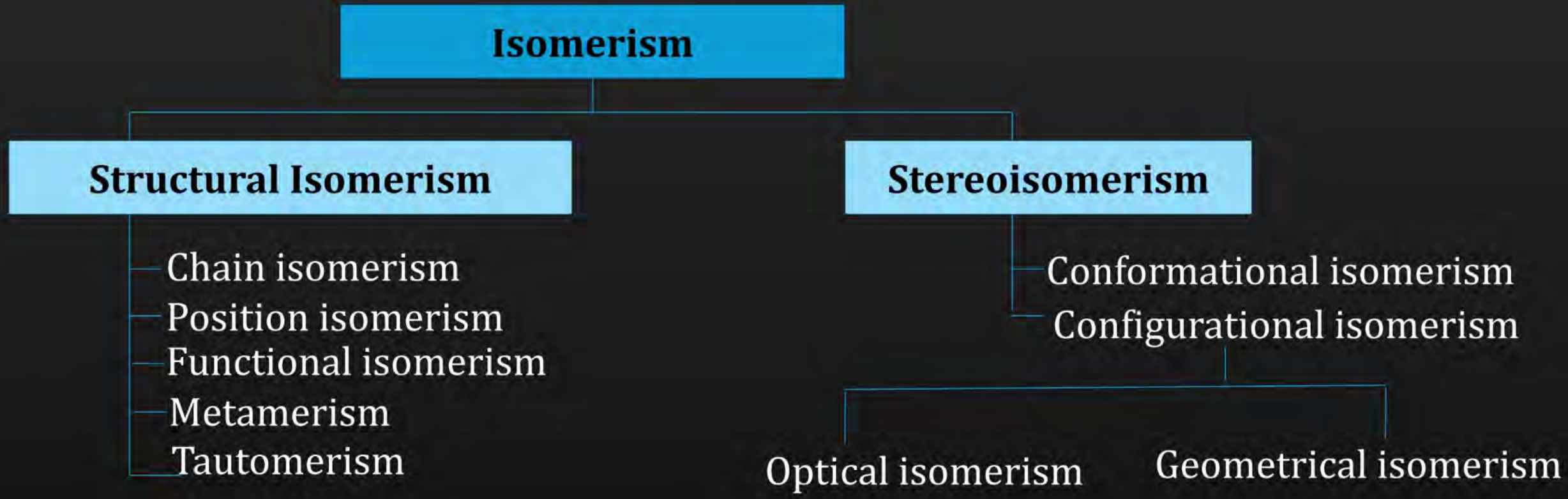


Isomerism

Two or more than two compounds having the same molecular formula but different physical/chemical or both properties are called isomers and the phenomenon is called isomerism



Isomerism


Isomerism
Structural Isomerism
Chain isomerism
Position isomerism
Functional isomerism
Metamerism
Tautomerism
Stereoisomerism
Conformational isomerism
Configurational isomerism
Optical isomerism
Geometrical isomerism

Chain Isomerism (C.I.)

The compounds which have same molecular formula, same functional group but different arrangement of carbon chain (Parental or side chain) show chain isomerism.

Ex. $CH_3–CH_2–CH_2–CH_3$

Butane (4C)

$CH_3–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_3$

2–Methyl propane (3C)

Ex. $CH_3–CH_2–CH_2–CH_2–OH$

1–Butanol (4C)

$CH_3–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–OH$

2–Methyl–1–propanol (3C)

Ex.

Methylcyclobutane

Cyclopentane

Position Isomerism (P.I.)

The compounds which have same molecular formula, same functional group, same parent carbon chain but different position of functional group or multiple bond or substituents, show position isomerism.

Ex. $CH_2=CH-CH_2-CH_3$

But–1–ene

$CH_3-CH=CH-CH_3$

But–2–ene

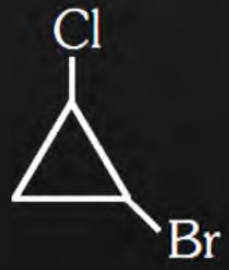
Ex. $CH_3-CH_2-CH_2-CH_2-OH$

1–Butanol

$CH_3-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$

2–Butanol

Ex.



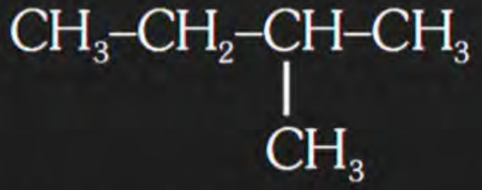
1-Bromo-2-chlorocyclopropane

1-Bromo-1-chlorocyclopropane

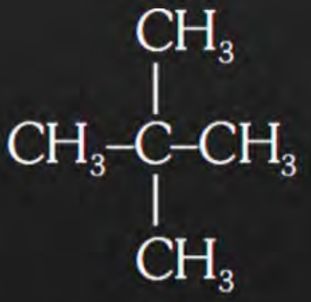
Example of CI and PI :

(i) C_5H_{12} has three structural isomers :

Pentane



2–Methyl butane



2,2–Dimethylpropane

(ii) C_6H_{14} has 5 structural isomers

(a) $CH_3CH_2CH_2CH_2CH_2CH_3$

Hexane

(b) $CH_3-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

2–Methyl pentane

(c) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_3$

3–Methyl pentane

(d) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

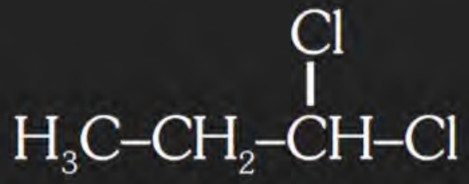
2,3–Dimethyl butane

(e) $H_3C-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2-CH_3$

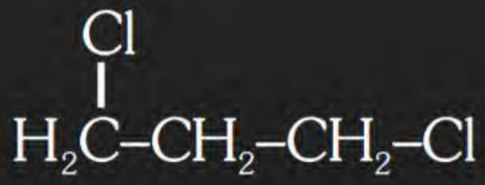
2,2–Dimethyl butane

- (a – b), (a – c), (a – d), (a – e) ⟶ Chain Isomers
  (b – d), (b – e), (c – d), (c – e)
- b–c, d–e ⟶ Position Isomers

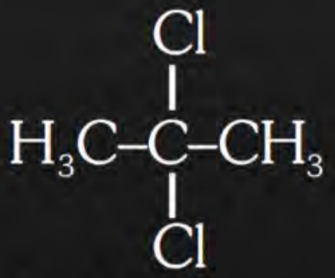
(iii) $C_3H_6Cl_2$ has 4 isomers : Position of chlorine atom is different in all the structure, so these are position Isomers.

a. 

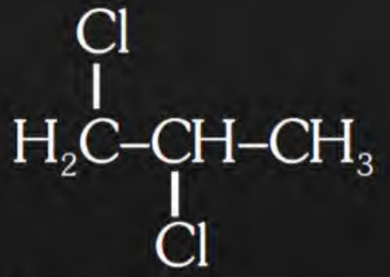
1,1-Dichloropropane

b. 

1,3-Dichloropropane

c. 

2,2-Dichloropropane

d. 

1,2-Dichloropropane

QUESTION

How many structural isomers of C_7H_{16} are possible ?

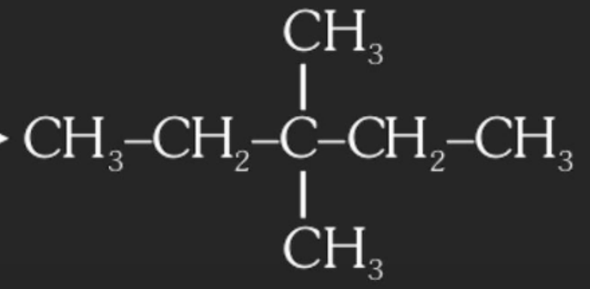
Ans :

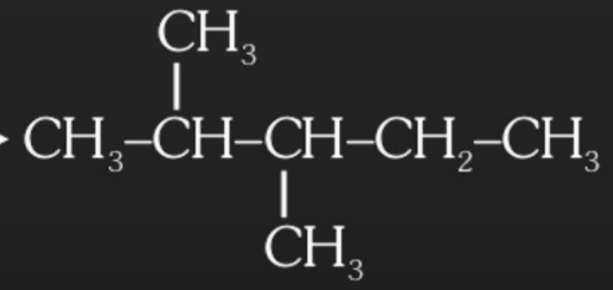
1 → $CH_3–CH_2–CH_2–CH_2–CH_2–CH_2–CH_3$ Heptane

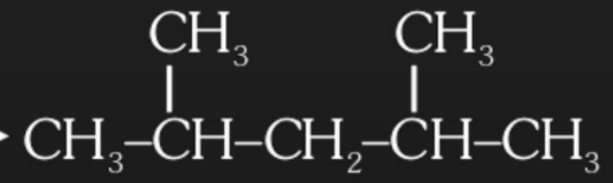
2 → $CH_3–CH_2–CH_2–CH_2–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_3$ 2–Methylhexane

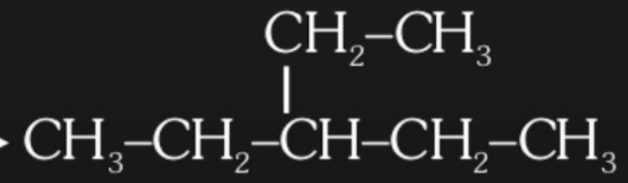
3 → $CH_3–CH_2–CH_2–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–CH_3$ 3–Methylhexane

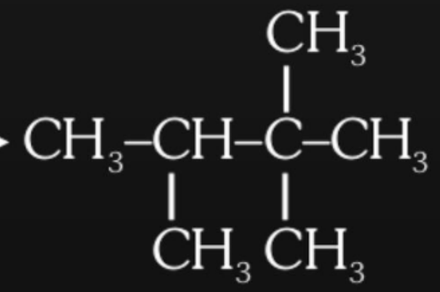
4 → $CH_3–CH_2–CH_2–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}–CH_3$ 2,2–Dimethyl pentane

5 →  3,3–Dimethylpentane

6 →  2,3–Dimethylpentane

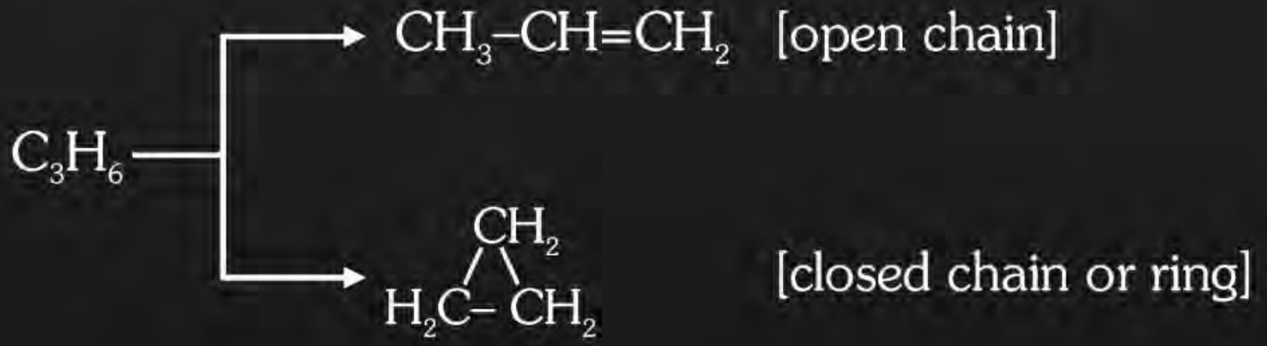
7 →  2,4–Dimethylpentane

8 →  3–Ethylpentane

9 →  2,2,3–Trimethylbutane
(Triptane)

Ring chain isomerism (RCI)

Same molecular formula but different mode of linking (open chain & closed chain) of carbon atoms.

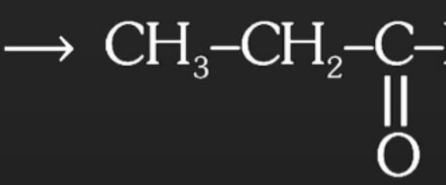
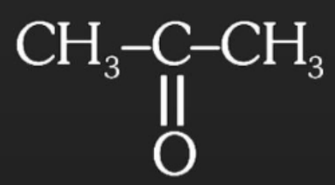


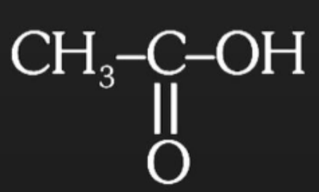
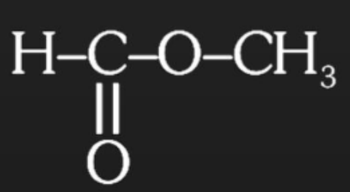
Functional Isomerism

Same molecular formula but different functional groups.

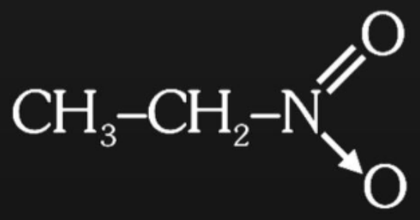
Following compounds show Functional isomerism, as they have same molecular formula and different functional group.

(i) Alcohol and Ether $\longrightarrow CH_3 - CH_2 - OH$ and $CH_3 - O - CH_3$

(ii) Aldehydes and Ketones $\longrightarrow$  and 

(iii) Acids and Ester $\longrightarrow$  and 

(iv) Cyanide and Isocyanide $\longrightarrow CH_3 - CH_2 - CH_2 - CN$ and $CH_3 - CH_2 - CH_2 - NC$

(v) Nitro and Nitrite $\longrightarrow$  and 

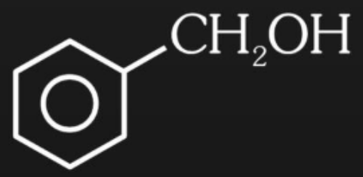
(vi) $1°, 2°, 3°$ Amines

(i) $CH_3 - CH_2 - CH_2 - NH_2$

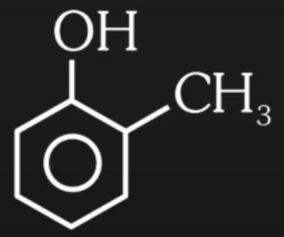
(ii) $CH_3 - NH - CH_2 - CH_3$

(iii) CH_3–N(–CH_3)–CH_3

(vii) Alcoholic and Phenolic compounds :



and



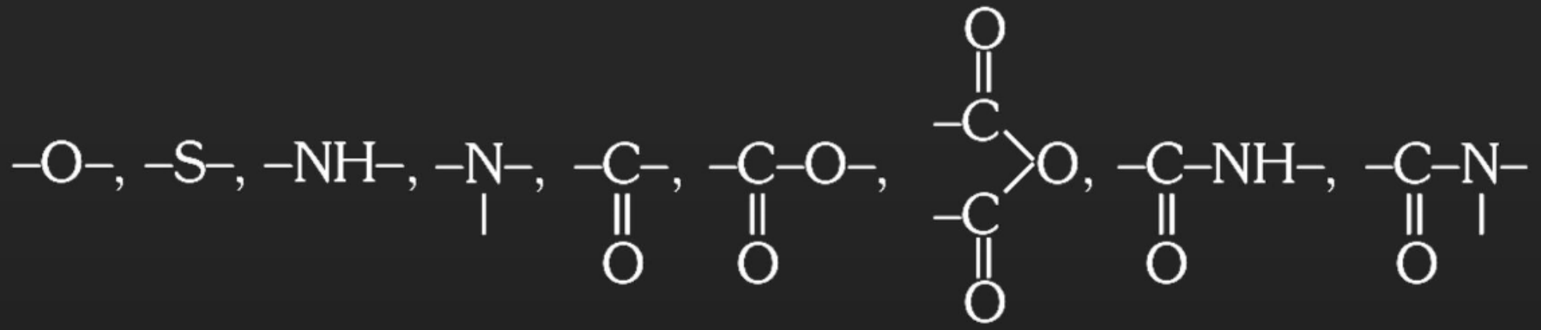
(viii) Alkyl halides do not show Functional isomerism.

(ix) $CH_3 - C \equiv CH$ propyne and $CH_2 = C = CH_2$ allene

Metamerism

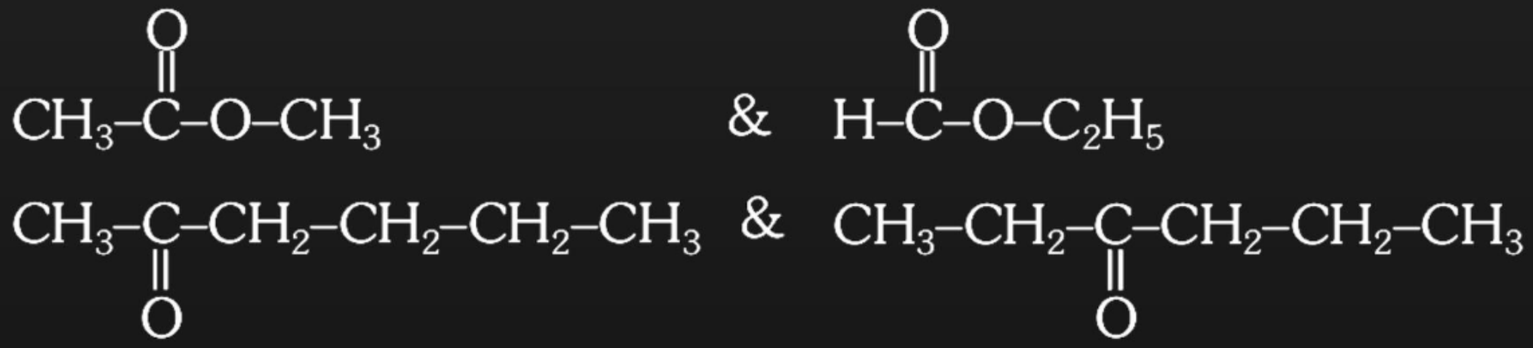
Same molecular formula, same polyvalent Functional group but different alkyl groups attached to polyvalent Functional group.

Polyvalent Functional group [Which have more than one valency] are :



Ex. $CH_3–O–CH_2–CH_2–CH_3$ & $H_3C–CH_2–O–CH_2–CH_3$

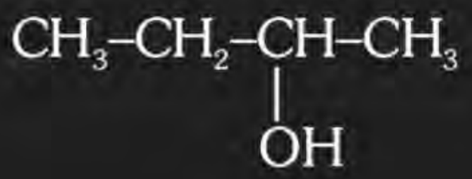
Ex. $CH_3–CH_2–NH–CH_2–CH_3$ & $CH_3–NH–CH_2–CH_2–CH_3$

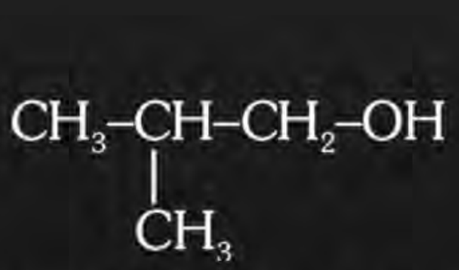


QUESTION

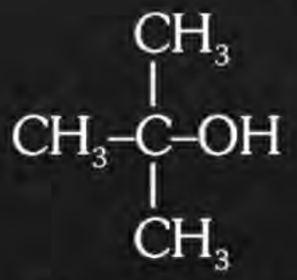
$C_4H_{10}O$ Structural isomers ⇒7 [4 alcohol and 3 ethers] total 7 structural isomers are possible.

Ans : **Alcohol :** $CH_3–CH_2–CH_2–CH_2–OH$





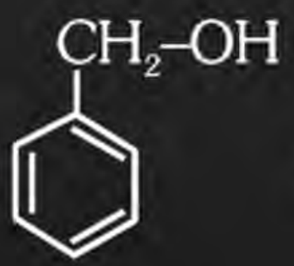
and

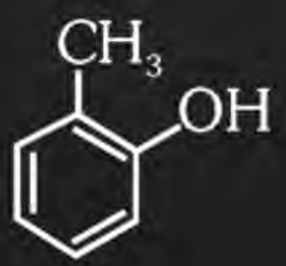


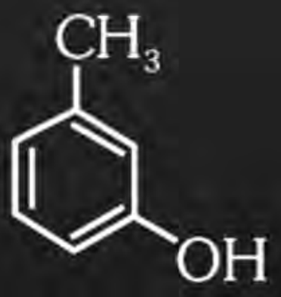
Ethers : $CH_3–O–CH_2–CH_2–CH_3$, $C_2H_5–O–C_2H_5$,

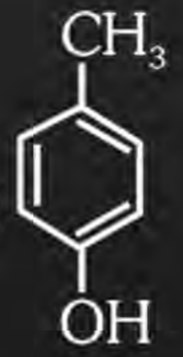
QUESTION

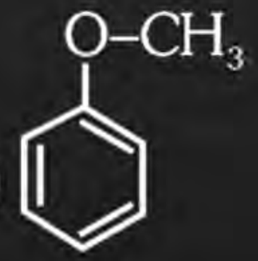
Aromatic isomers of C_7H_8O.

Ans : (a) 

(b) 

(c) 

(d) 

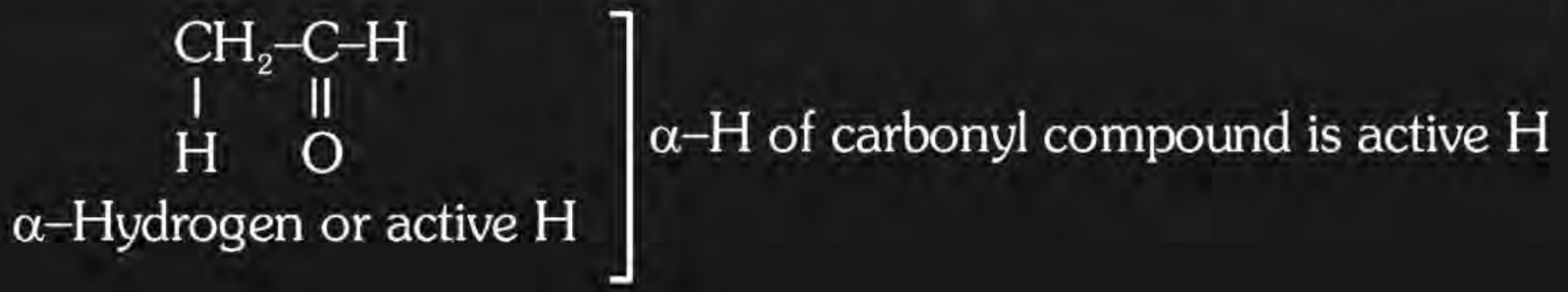
(e) 

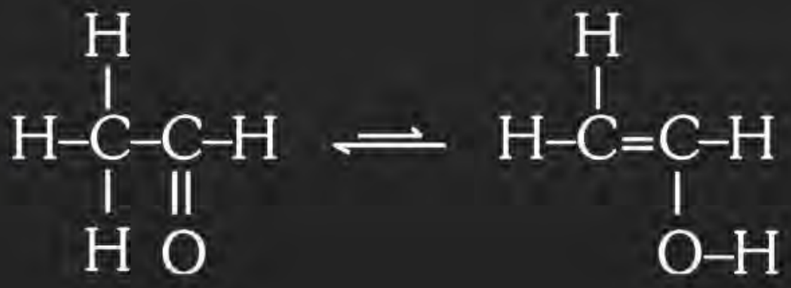
- a, b – Functional isomers
- c, d – Position isomers
- a, e – Functional isomers
- b, c – Position isomers
- a, d – Functional isomers
- a, c – Functional isomers

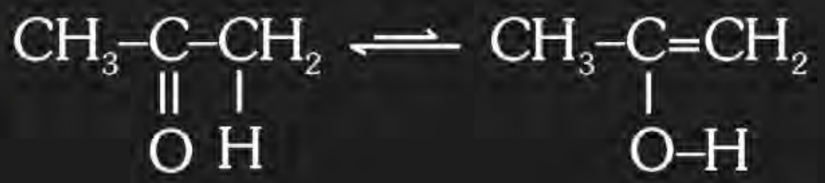
Note : Alcoholic and phenolic groups are Functional isomers.

TAUTOMERISM OR DESMOTROPISM

- Tautomers have same molecular formula but different structural formula due to migration of active hydrogen from one polyvalent atom to another polyvalent atom. This pnenomena is known as tautomerism.
- Desmotropism means bond turning. [Desmos = Bond; Tropos = Turn]



Ex. 

Ex. 

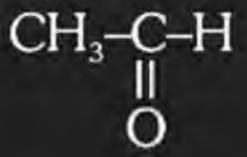
keto ene + ol = enol

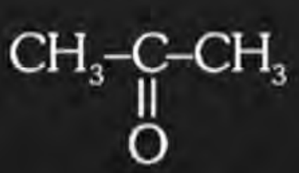
Note : (1) Tautomers exist in dynamic equilibrium.

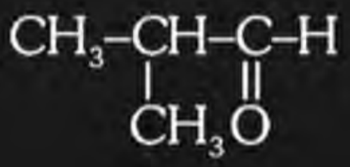
(2) By shifting of H–atom, π bond also changes its position.

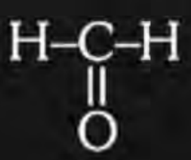
(I) Condition for Tautomerism :

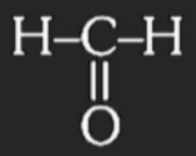
(a) For carbonyl compounds : Carbonyl compounds having at least one active-H (α–H) show tautomerism

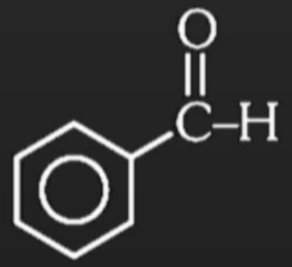
(i)  3 α H, shows tautomerism.

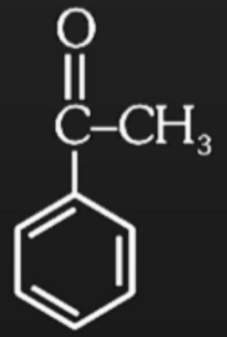
(ii)  6 α H, shows tautomerism

(iii)  1 α H, shows tautomerism

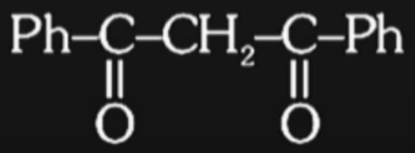
(iv)  No α H, No tautomerism

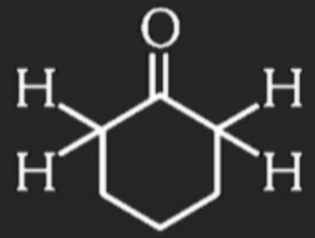
(iv)  No α H, No tautomerism

(v)  No α H, No Tautomerism

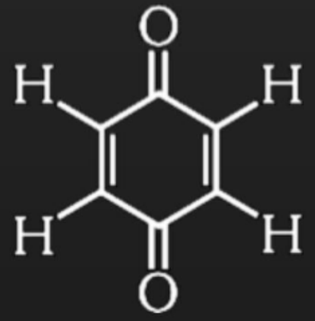
(vi)  (Acetophenone) 3 α H, shows tautomerism (Acetophenone)

(vii)  (Benzophenone) No α H, No tautomerism (Benzophenone)

(viii)  2 α H, shows tautomerism

(ix) 

4 α H, shows tautomerism

(x) 

α–H, attached sp^2 carbon does not initiate in tautomerism

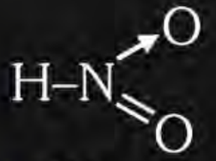
(b) **For nitro compounds :** Nitro compounds having at least one active-H (α – H) show tautomerism

Nitro form

Acinitro form
(acidic form so soluble in base)

(c) H – C ≡ N and H – N ⇇ C are tautomers [also Functional isomers] while R – C ≡ N and R – N ⇇ C are only Functional isomers.

Active H

(d)  and H–O–N=O are tautomers.

Note : Nitro compounds with at least one α–H are soluble in NaOH.

(II) Enol Content :

1. 

"keto" (≈99%) "enol" (≈1%)

2. 

"keto" (≈1%) "enol" (stable by resonance and aromatic nature) (≈99%)

Stereo Isomerism

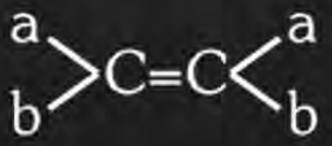
Two or more than two compounds having same molecular formula, same structural formula but different arrangements of atoms or groups in space.

Geometrical isomerism (G. I)

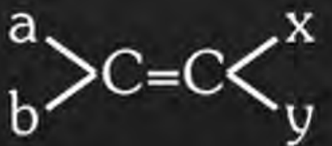
(i) Alkenes (>C=C<), oximes (>C=N—OH) and azo compounds [—N=N—] etc., show G. I. due to restricted rotation about double bond and (ii) cycloalkanes show G. I. due to restricted rotation about single bond in ring.

Condition for Geometrical isomerism :

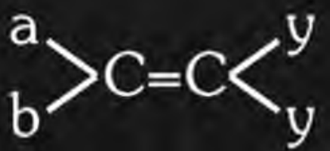
Only those alkenes show G. I. in which "Each sp2 carbon individually have different atoms or groups"



Geometrical isomerism possible



Geometrical isomerism possible

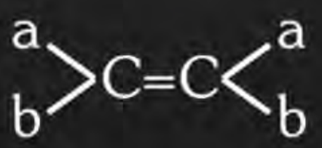


Geometrical isomerism not possible

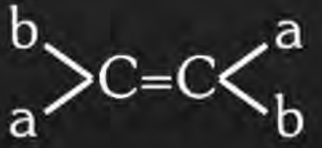
Geometrical isomerism not possible

Nomenclature Systems of Geometrical isomers

(a) Cis–Trans System : If same groups are at same side then cis and if same groups are at different side then trans.

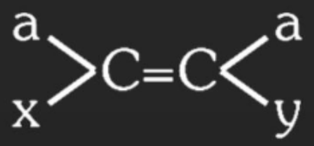


[Same groups, same side]
cis

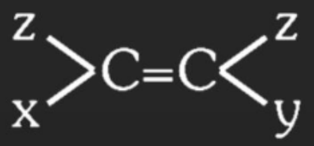


[Same groups different side]
trans

Ex.

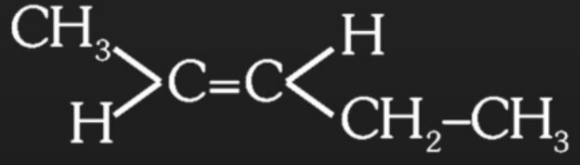


cis



cis

Ex.



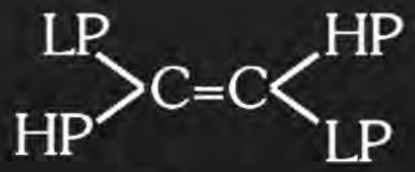
trans-2–pentene

It does not show Geometrical isomers
So no cis–trans

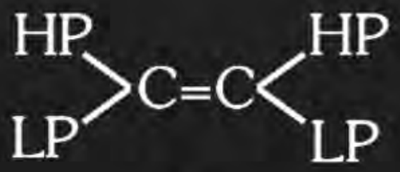
(b) E – Z System :

E (Entgegen) : When high priority groups are at opposite side.

Z (Zusamman) : When high priority groups are at same side.



'E'

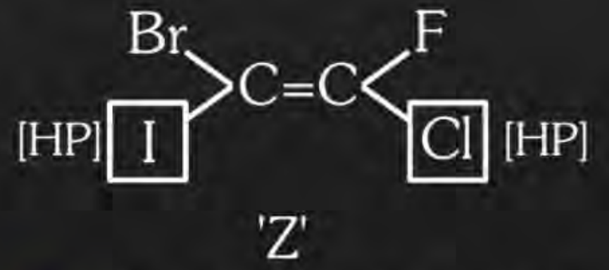


'Z'

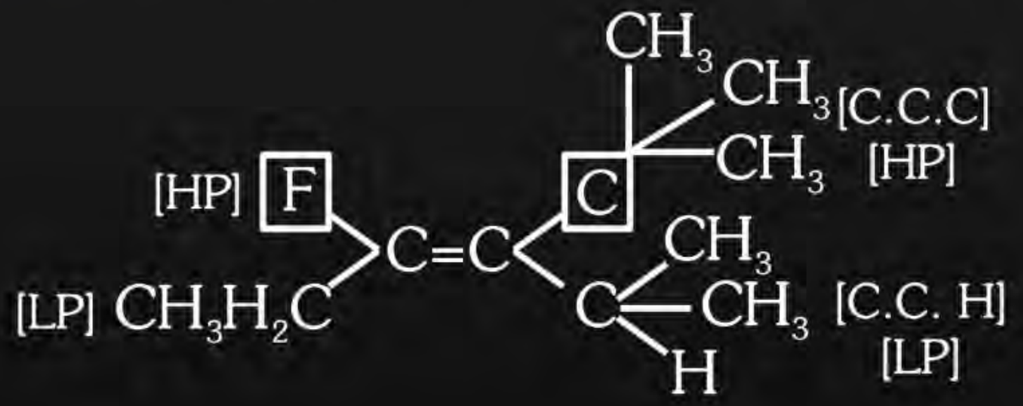
HP – High priority and LP – Low priority

Priority Rules [CIP Sequence Rule] :

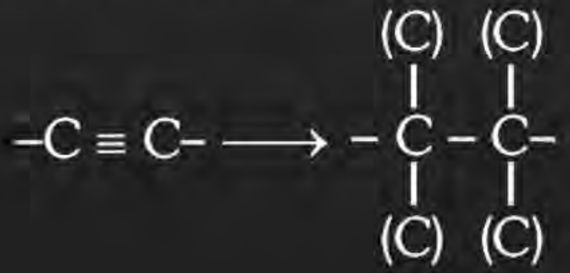
Rule I : Priority is proportional to atomic number of atom which is directly attached to sp^2 carbon.

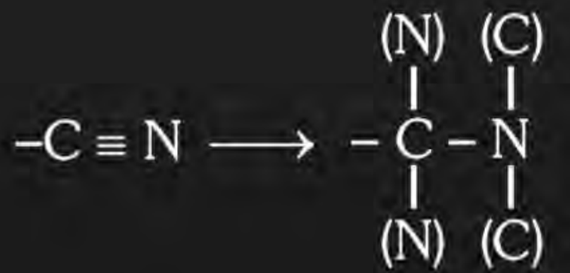


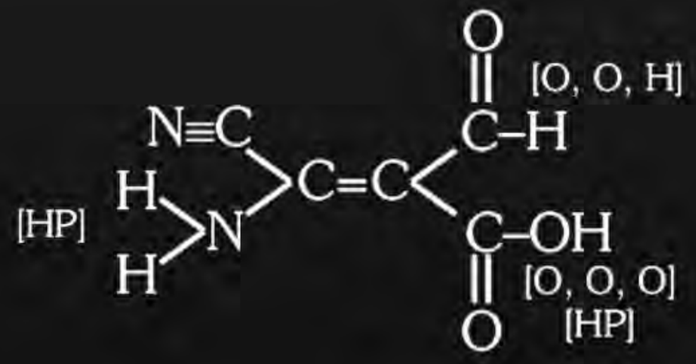
Rule II : If rule-I is failed then consider the atomic number of next atom and so on.



Rule III : If multiple bond is present then consider them as :

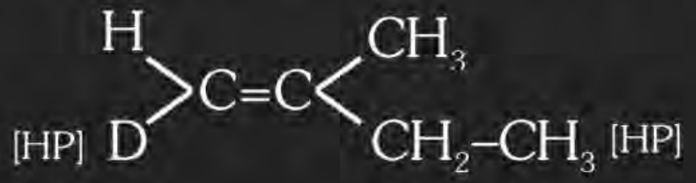






'Z'

Rule IV : If isotopes are present then consider atomic weight.



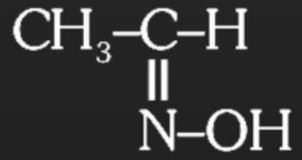
'Z'

GEOMETRICAL ISOMERS IN OXIMES [>C = N–OH]

- Oximes show G. I. due to restricted rotation about double bond.
- Only those oximes show Geometrical isomerism in which sp^2 carbon have two different groups.

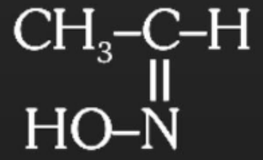
$CH_3 - CH = O + H_2 \rightarrow CH_3 - CH = N - OH$ (oxime)

Ex. Acetaldoximes has two Geometrical isomers –



syn

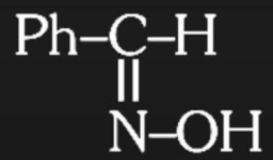
When H and OH are on the same side.



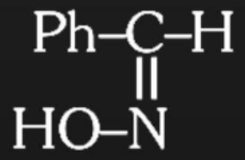
anti

When H and OH are on the opposite side

Ex. Benzaldoxime

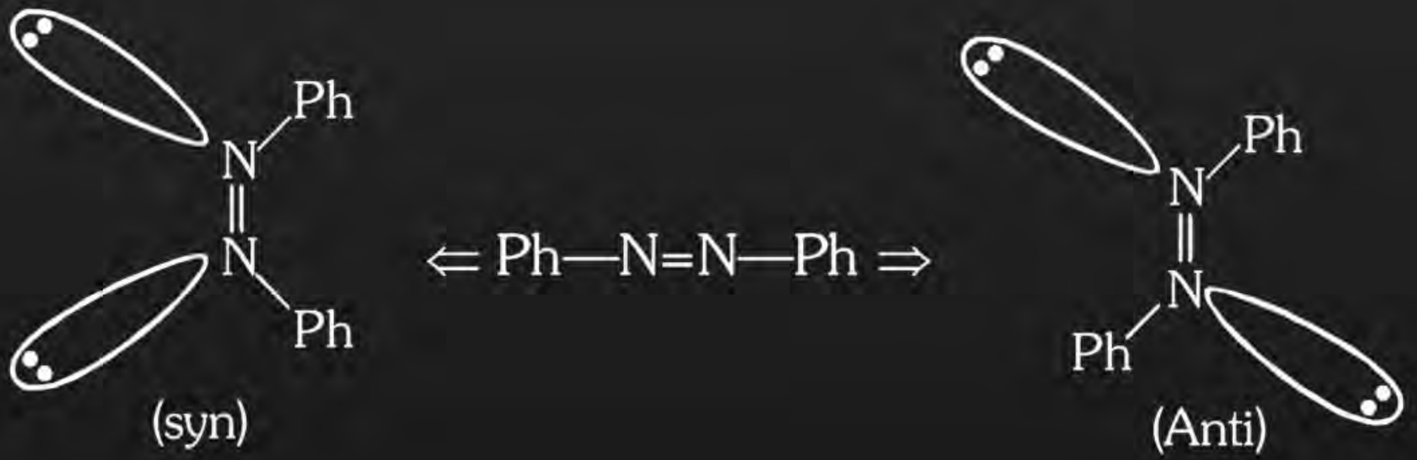


[Syn.]



[Anti]

GEOMETRICAL ISOMERS IN AZO COMPOUNDS (–N=N–)

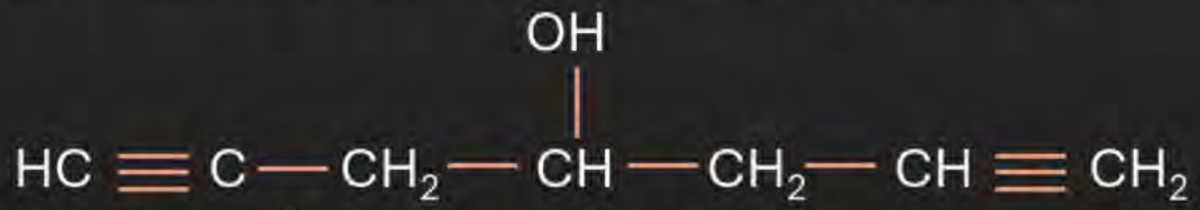


GEOMETRICAL ISOMERS IN CYCLOALKANES

Cycloalkanes show Geometrical isomerism due to restricted rotation about single bond. Only those cyclo alkanes show Geometrical isomers in which atleast two different carbons have two different groups.

Question

The IUPAC name of the following compound is:



(A) 4-hydroxyhept-6-en-1-yne

(B) 4-hydroxyhept-1-en-6-yne

(C) Hept-6-en-1-yn-4-ol

(D) Hept-1-en-6-yn-4-ol

(4 Apr 2nd Shift 2025)

Question

What is the correct IUPAC name of

A 4-ethylcyclopent-2-en-1-ol

B 4-ethyl-1-hydroxycyclopent-2-ene

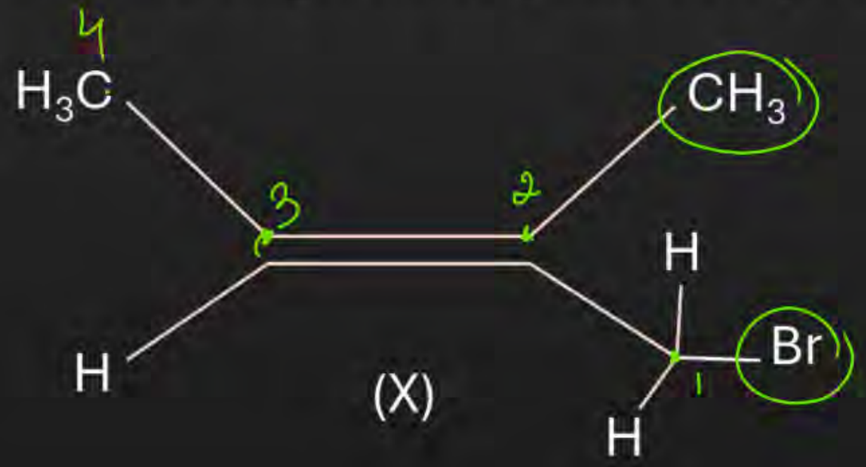
C 1-ethyl-3-hydroxycyclopent-2-ene

D 1-ethylcyclopent-2-en-3-ol

(8 Apr 2nd Shift 2026)

Question

Which of the following is the correct IUPAC name of given organic compound (X)?



(X)

A 1-bromo-2-methylbut-2-ene

B 3-bromo-3-methylprop-2-ene

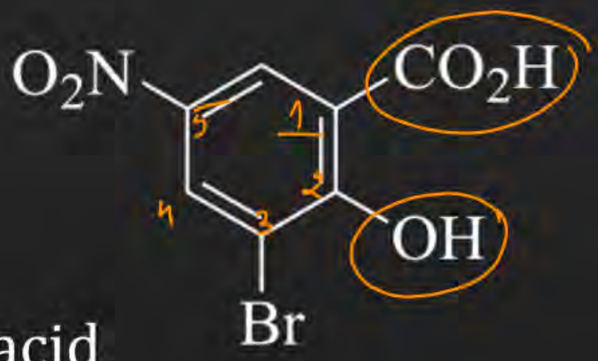
C 2-bromo-2-methylbut-2-ene

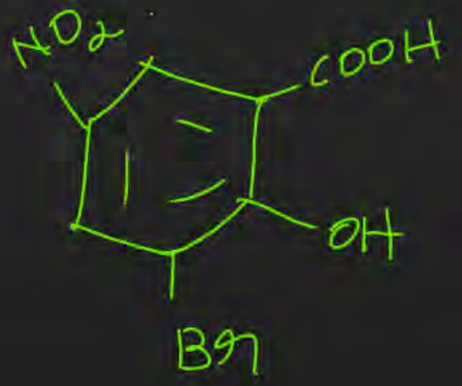
D 4-bromo-3-methylbut-2-ene

7 Apr 1st Shift 2025)

Question

What is the correct IUPAC name of





A. 3-bromo-4-hydroxy-1-nitrobenzoic acid

B. 3-bromo-2-hydroxy-5-nitrobenzoic acid

C. 5-nitro-3-bromo-2-hydroxybenzoic acid

D. 2-hydroxy-3-bromo-5-nitrobenzoic acid

(2025)

Question

In 3,3-dimethylhex-1-en-4-yne, there are. .....sp^2 and .....sp hybridised carbon respectively.

A 4, 2, 2

B 3, 3, 2

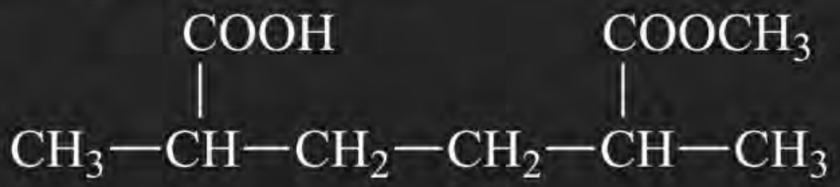
C 2, 4, 2

D 2, 2, 4

(28th Jan 2nd Shift 2026)

Question

The IUPAC name of the following compound:



A Methyl-6-carboxy-2, 5-dimethylhexanoate

B Methyl-5-carboxy-2-methylhexanoate

C 2-carboxy-5-methoxycarbonylhexane

D 6-methoxycarbonyl-2, 5-dimethylhexanoic

(2025)

Question

In the given structure, number of sp and s hybridised carbon atoms present respectively

A 3 and 5

B 3 and 6

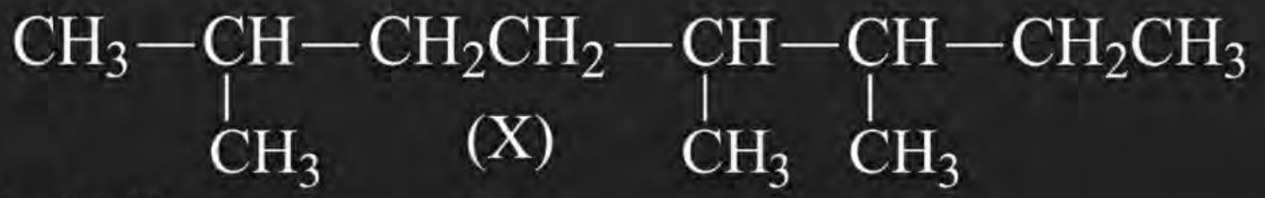
C 4 and 6

D 4 and 5

(2025)

Question

IUPAC name of following hydrocarbon (X) is



(X)

A 2-ethyl-2, 6-diethylheptane

B 3, 4, 7-trimethyloctane

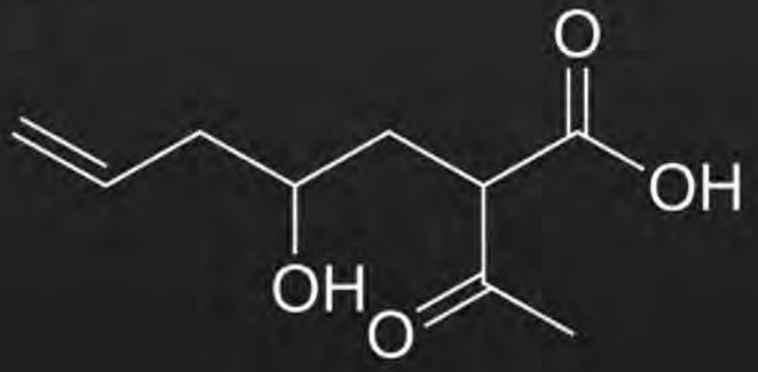
C 2-ethyl-3, 6-dimethylheptane

D 2, 5, 6-trimethyloctane

(9 Apr 2nd Shift 2024)

Question

The correct nomenclature for the following compound is



A 2-carboxy-4-hydroxyhept-7-enal

B 2-formyl-4-hydroxyhept-6-enoic acid

C 2-formyl-4-hydroxyhept-7-enoic acid

D 2-carboxy-4-hydroxyhept-6-enal

(5 Apr 2nd Shift 2024)

Question

IUPAC name of following compound (P) is

(P)

A 1, 1-dimethyl-3-ethylcyclohexane

B 3-ethyl-1, 1-dimethylcyclohexane

C 1-ethyl-3, 3-dimethylcyclohexane

D 1-ethyl-5, 5-dimethylcyclohexane

(27th Jan 1st Shift 2024)

Question

The correct decreasing order of priority of functional groups in naming an organic compound as per IUPAC system of nomenclature is

A -COOH>- $CONH_2$ >- COCl >- CHO

B $-SO_3H$>-COCl>- $CONH_2$>-CN

C -COOR - COOR>- COCl >-NH_2 > >C=0

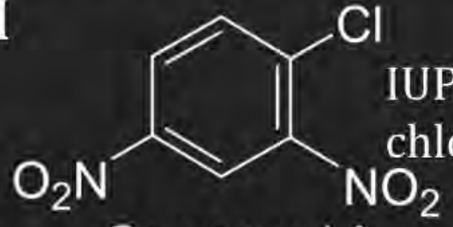
D -COOH > - COOR > $CONH_2$ >- COCl

(26 Jul 2nd Shift 2022)

Question

Given below are two statements :

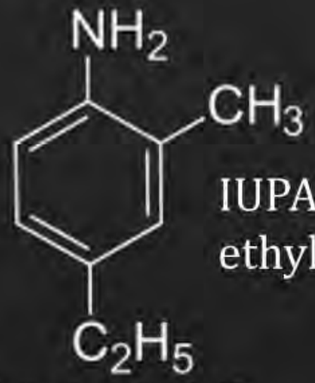
Statement I



Compound A

IUPAC name of compound A is 4-chloro-1, 3-dinitrobenzene

Statement II



Compound B

IUPAC name of compound B is 4-ethyl-2-methylaniline

In the light of the above statements. Choose the most appropriate answer from the options given below :

A Statement I is incorrect but Statement II is correct.

B Both Statement I and Statement II are incorrect.

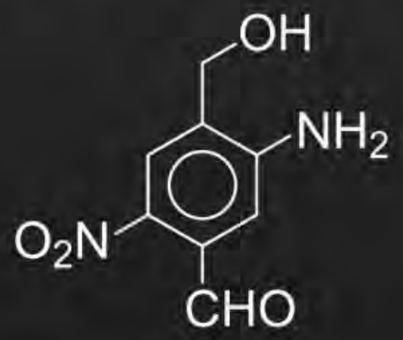
C Statement I is correct but Statement II is incorrect.

D Both Statement I and Statement II are correct.

(8 Apr 1st Shift 2024)

Question

The IUPAC name of the following compounds is



A 2-nitro-4-hydroxymethyl-5-amino benzaldehyde

B 3-amino-4-hydroxymethyl-1-5- nitrobenzaldehyde

C 5-amino-4-hydroxymethyl-2-nitrobenzaldehyde

D 4-amino-2-formyl -5- hydroxymethyl -nitrobenzene

(6 Sep 2nd Shift 2020)

Question

Match List I with List II.

	List I		List II
A.	Carbocation	I.	Species that can supply a pair of electrons.
B.	C-Free radical	II.	Species that can receive a pair of electrons
C.	Nucleophile	III.	sp^2 hybridised carbon with empty p-orbital.
D.	Electrophile	IV.	sp^2/sp^3 hybridised carbon with one unpaired electron.

(A) A-II, B-III, C-I, D-IV

(B) A-III, B-I, C-IV, D-II

(C) A-III, B-IV, C-I, D-II

(D) A-IV, B-III, C-I, D-II

III IV

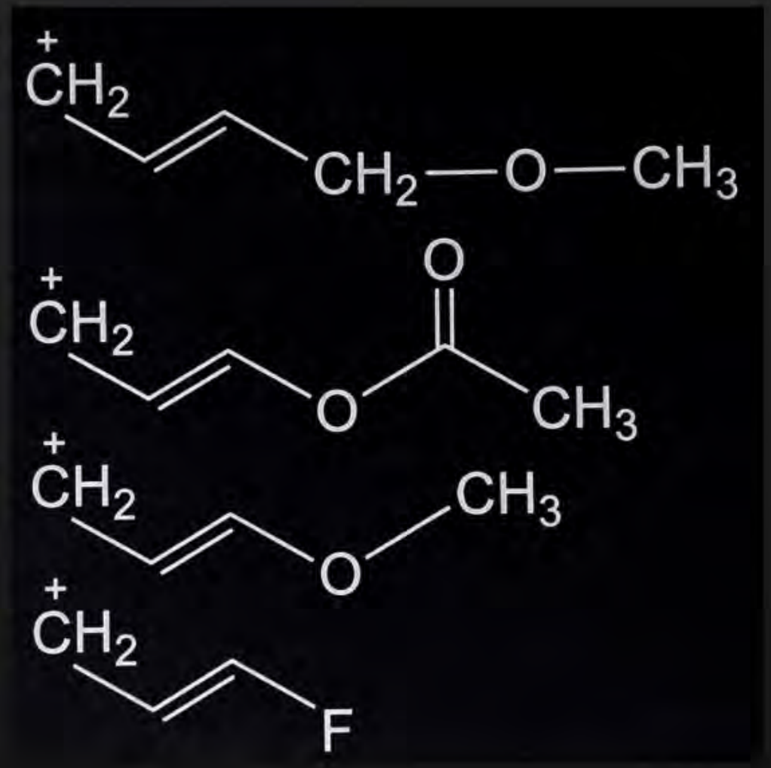
empty unhybridized p orbital

(8 Apr 2nd Shift 2025)

Question

Which one of the carbocations from the following is most stable?

A



B

C

D

(24th Jan 1st Shift 2025)

Question

A species having carbon with sextet of electrons and can act as electrophile is called

A pentavalent carbon

B carbanion

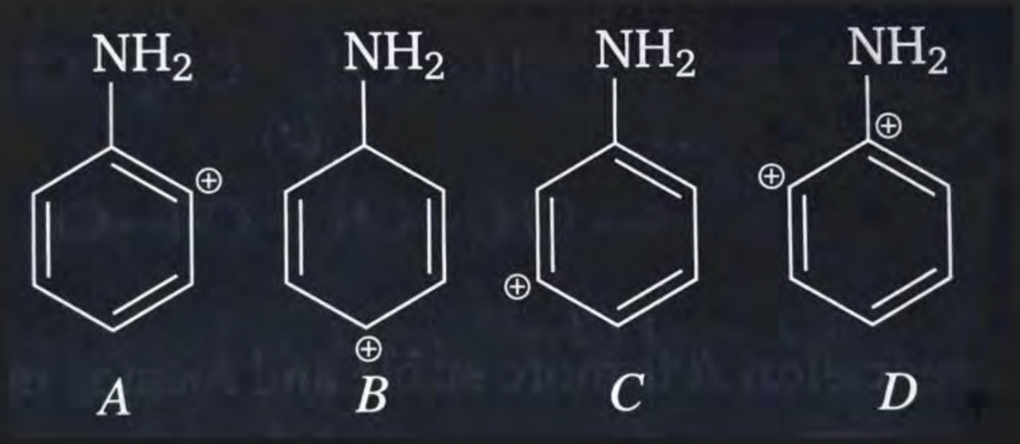
C carbon free radical

D carbocation

(31 Jan 1st Shift 2024)

Question

The most stable carbocation for the following is



A D

B C

C B

D A

(28th Jan 2nd Shift 2026)

Question

The correct order of nucleophilicity is

A $F^- > OH^-$

B $H_2\ddot{O} > OH^-$

C $R\ddot{O}H > RO^-$

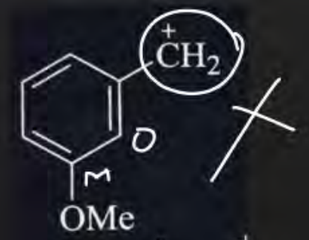
D $NH_2^- > NH_3$

(26 Jun 2nd Shift 2022)

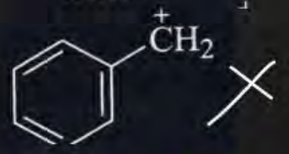
Question

The most stable carbocation from the following is

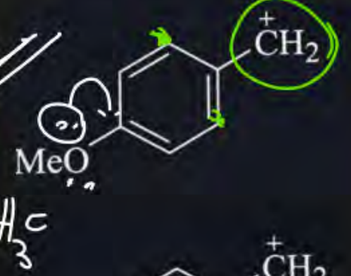
A



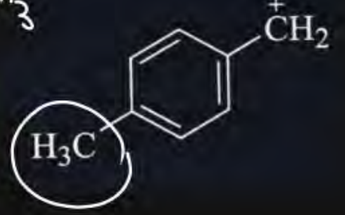
B



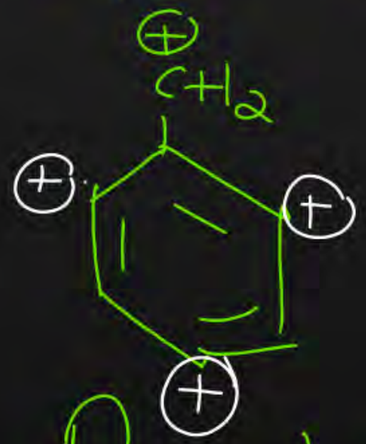
C



D



EDG → $\ddot{O}CH_3$, CH_3, $\ddot{N}H_2$, $\ddot{O}H$

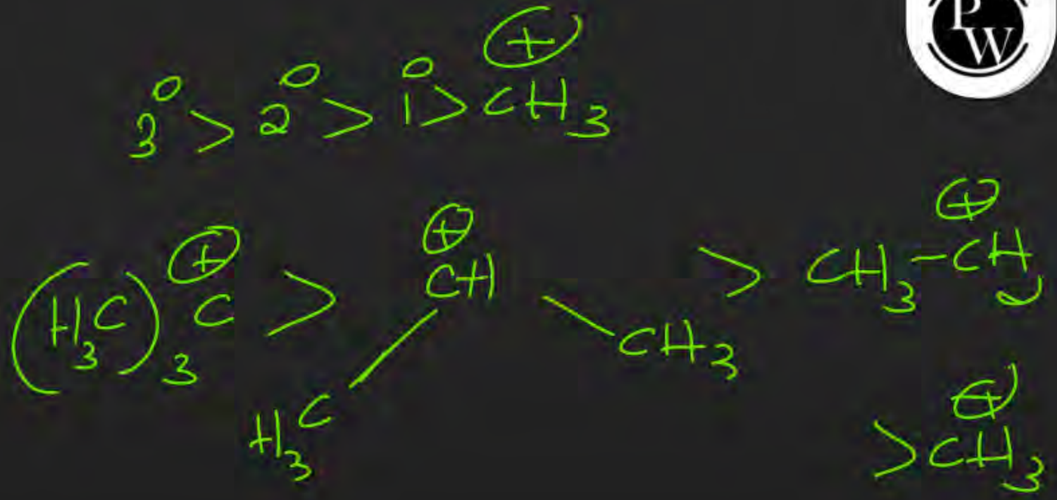


Benzyl carbocation

(28th Jan 2nd Shift 2026)

Question

The correct stability order of carbocations is



A $(CH_3)_3\overset{+}{C} > CH_3\text{-}\overset{+}{C}H_2 > (CH_3)_2\overset{+}{C}H > \overset{+}{C}H_3$

B $\overset{+}{C}H_3 > (CH_3)_2\overset{+}{C}H > CH_3\text{-}\overset{+}{C}H_2 > (CH_3)_3\overset{+}{C}$

C $\overset{+}{C}H_3 > CH_3\text{-}\overset{+}{C}H_2 > CH_3\text{-}\overset{+}{C}H > (CH_3)_3 > \overset{+}{C}$

D $(CH_3)_3\overset{+}{C} > (CH_3)_2\overset{+}{C}H > CH_3\text{-}\underset{CH_3}{\overset{+}{C}H}\text{-}CH_2 > \overset{+}{C}H_3$

3° 2° 1°

(30 Jan 2nd Shift 2024)

Question

Which of the following is most stable?

→ Aromatic Hydrocarbon.

↓

$(4n+2)\pi e^{\ominus}$

A

B

C

D

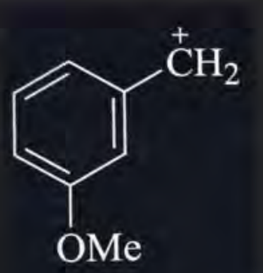
Antiaromatic

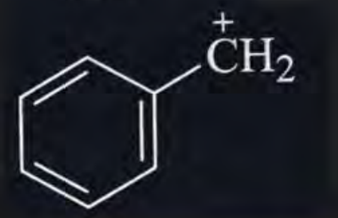
Non aromatic

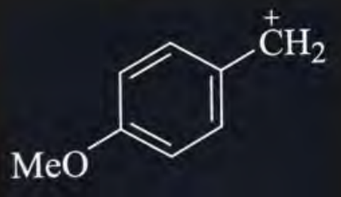
(28th Jan 2nd Shift 2026)

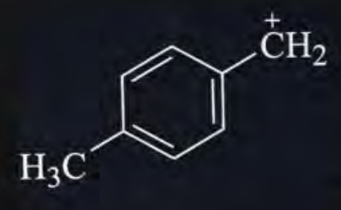
Question

The most stable carbocation from the following is

A 

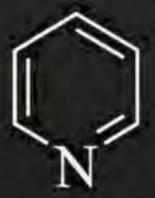
B 

C 

D 

Question

Which of the following is homocyclic compound?

A 

B 

C 

D 

Question

IUPAC name of the given structure is,

A 3-methylbutane

B 2,2-dimethylbutane

C iso-pentane

D 2-methylbutane.

Question

IUPAC name of the given structure is,

A hexane

B iso-pentane

C 3-ethylbutane

D 3-methylpentane.

Question

The IUPAC name of the alkane  is

A. 2,2,6,6,7-pentamethyloctane

B. 2,3,3,7,7-pentamethyloctane

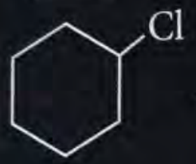
C. 5-tert-butyl-2-isopropyl-2-methylpentane

D. 2-isopropyl-2,6,6-trimethylheptane.

Question

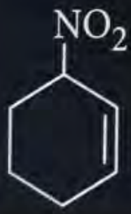
Which of the following IUPAC names is not correctly matched?

A  - Cyclopentane

B 

- Chlorocyclohexane

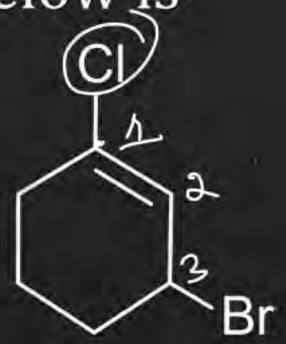
C  - 1,1-Dimethylcyclohexane

D 

- 3-Nitrocyclohexene

Question

The IUPAC name of the compound shown below is



A 2-bromo-6-chlorocyclohex-1-ene

B 6-bromo-2-chlorocyclohexene

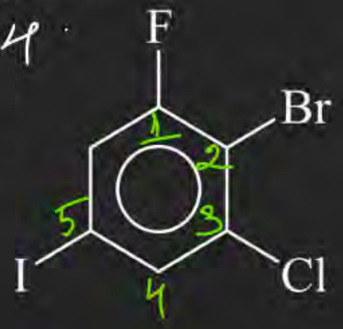
C 3-bromo-1-chlorocyclohexene

D 1-bromo-3-chlorocyclohexene.

3-Bromo - 1 - chloro cyclohex-1-ene

Question

Br, Cl, F, I.
1 2 3 4.

The correct name of  is

locant value

1+2+4+6 = 13

1+2+3+5 = 11

A 1-bromo-2-chloro-6-fluoro-4-iodobenzene ✗

B 1-bromo-6-chloro-2-fluoro-4-iodobenzene ✗

C 2-bromo-1-chloro-3-fluoro-5-iodobenzene ✓

D 2-bromo-3-chloro-1-fluoro-5-iodobenzene

11

→ Alphabetical order.

→ lowest set of locants.

CIP

Question

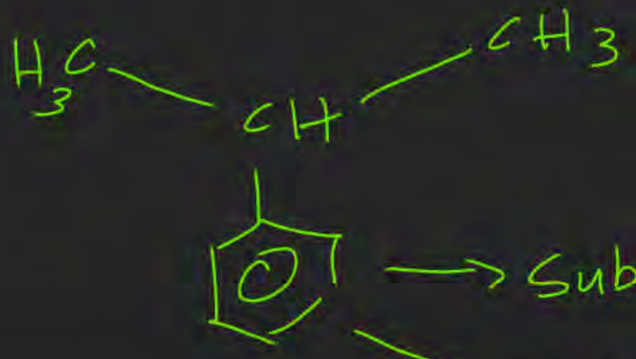
The correct IUPAC name of  is

A iso-propylbenzene

B cumene

C phenylisopropane

D 2-phenylpropane



→ Substituent

→ common name

↓

Isopropyl benzene

2-phenyl propane

Question

What is the minimum number of carbon atoms of an alkane must have to form an isomer?

A 4

B 3

C 2

D 1

Question

Can homologues be isomers?

A Yes

B No

C Sometimes

D None of these

Question

The type of isomerism observed in urea molecule is

A functional isomers

B optical isomers

C positional isomers

D cis-trans isomers.

Question

How many chain isomers could be obtained from the alkane C_6H_{14}?

A Four

B Five

C Six

D Seven

Question

An isomer of ethanol is

A methanol

B diethyl ether

C acetone

D dimethyl ether

Question

In which of the following, functional group isomerism is not possible?

A. Alcohols

B. Aldehydes

C. Alkyl halides

D. Cyanides

Question

Amines exhibit

A position isomerism

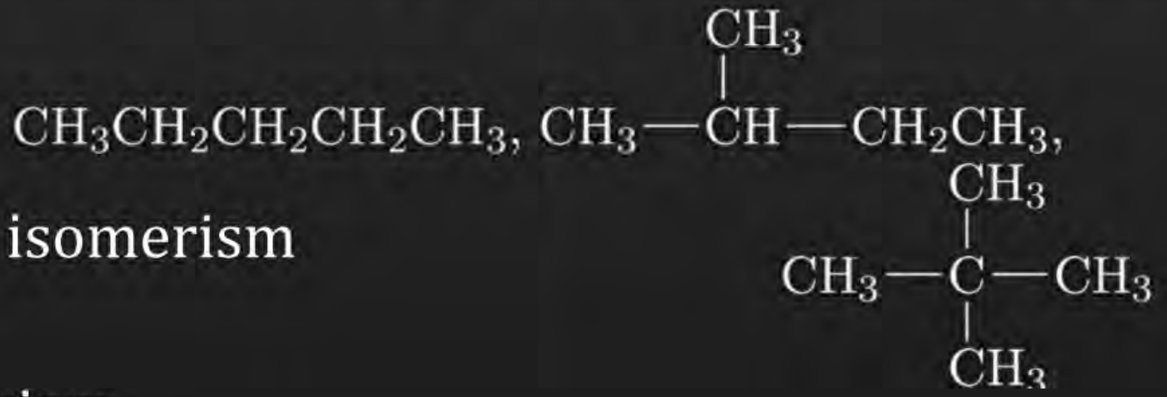
B functional isomerism

C metamerism

D all are correct

Question

The type of isomerism shown by the following compounds is



A position isomerism

B metamerism

C ring-chain isomerism

D chain isomerism.

Question

The total number of cyclic isomers possible for a hydrocarbon with the molecular formula C_4H_6 is _____ .

A 4

B 5

C 6

D 3

Question

The number of isomers in $C_4H_{10}O$ will be

A 7

B 8

C 5

D 6

Question

o-Hydroxytoluene and benzyl alcohol are

A position isomers

B functional isomers

C chain isomers

D none of these

Question

In which of the following homolytic bond fission takes place?

A Generation of carbocation

B Generation of carbanion

C Generation of free radical

D Generation of any anion

Question

Which of the following statements is not true about the stability of carbanions?

A Stability of carbanions increases with increase in *s*-character of orbital.

B The electron withdrawing groups like $-NO_2$ $-CN > c = O$ increases the stability of carbanions.

C Order of stability of carbanions is $3° > 2° > 1°$

D The negatively charged carbon is sp^3 hybridised and pyramidal.

Question

Which of the following sets of groups contain only electrophiles?

A NH_2^- NO_2^+ H_2O NH_3 ✗

B F^- OH^-, NH_3 SO_3 ✗

C NO_2^+ $AlCl_3$, SO_3, $CH_3\overset{+}{C}=O$ → $H_3C-\overset{+}{C}=O$ ✓

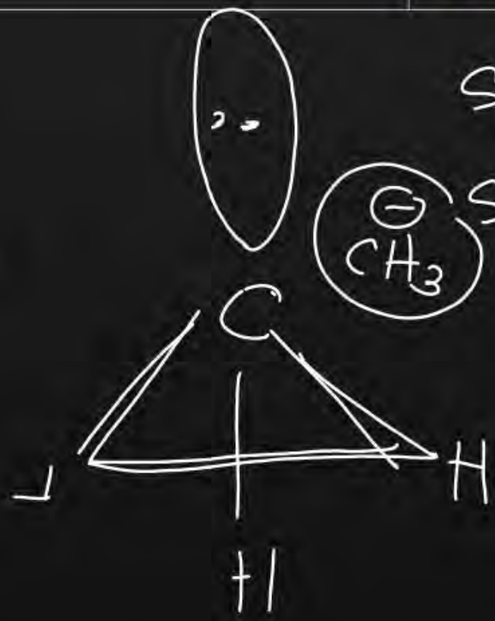
D NH_3 BF_3 $AlCl_3$, H_2O

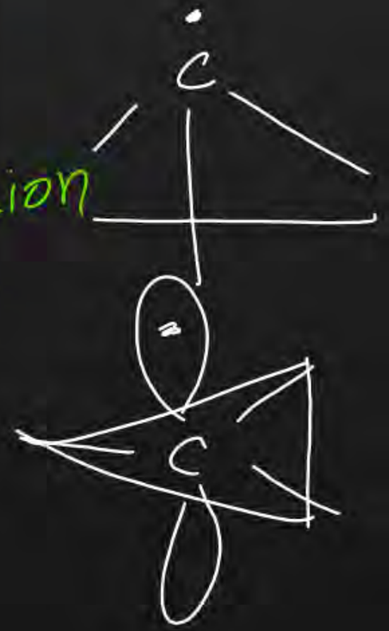
Nucleophile — Electrophile — Nucleophile

Question

Match the intermediates given in Column I with their probable structures in Column II.

	Column I		Column II
A.	Free radical	I.	Trigonal planar
B.	Carbocation	II.	Pyramidal
C.	Carbanion	III.	~~Linear~~ sp^2 hybridization with odd electron.





(A) A-(i); B-(iii); C-(ii)

(B) A - (ii) B-(iii); C - (i)

(C) A - (i) B-(i); C-(ii)

(D) A-(i); B-(ii); C-(iii)

Thank You