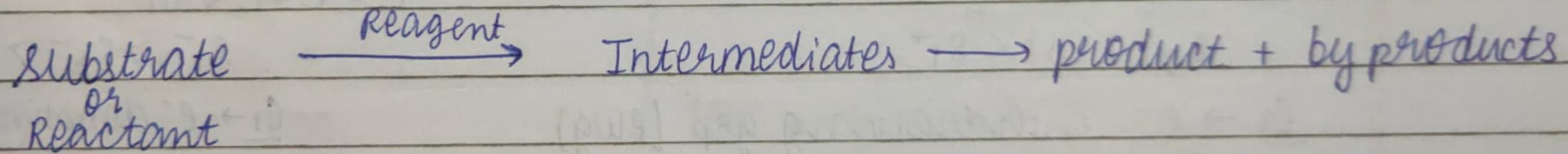


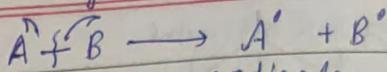
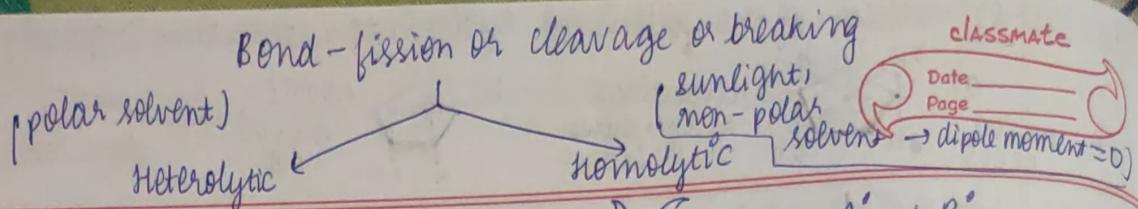
GOC

① Reactive intermediates -



* intermediates formed depends on bond fission or bond cleavage or bond breaking.

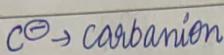
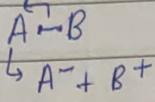
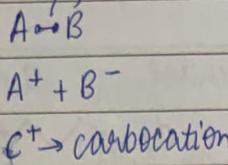
Bond fission kaise hogi depends on reagent & reactant used.



free radicals

apna e- vapis mile den skoj

C^{\bullet} → carbon free radical



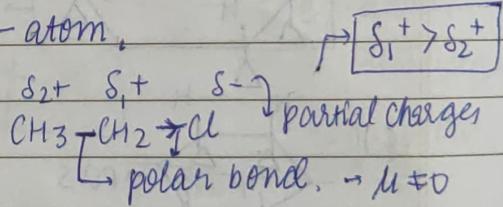
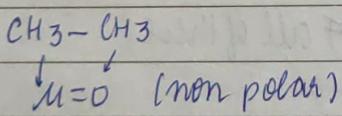
* more than one
intermediates possible in a rxn.

effects → Permanent effect → (always operate in a molecule)
Jo ek molecule me hmeha hoga, reactant Balnekinewa

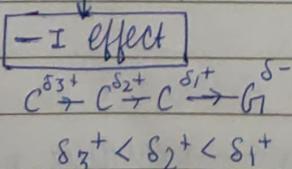
↳ Temporary effect → Jo reagent ke karan aye -

• Permanent effects -

- Inductive effect - (ek atom ya grp ke karan dusre pe charge induced)
- operates to σ bond (for saturated & unsaturated both)
- partial charge development due to E.N. diff.
- distance dependent (dec. with distance).
- can be neglected after 3rd C-atom.

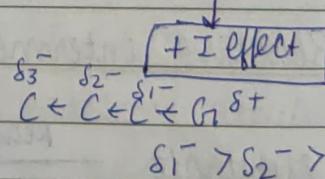


Types



$G^- \rightarrow e^-$ withdrawing grp (ewg)
or e^- seeking grp (esg)

or $-I$ grp.



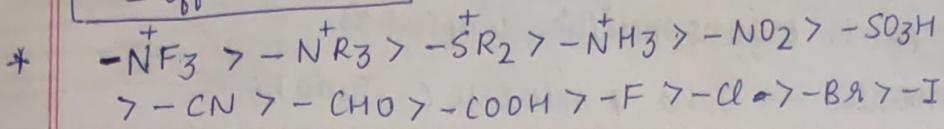
$G^- \rightarrow e^-$ donating grp (edg)
or e^- releasing grp (er.g)

or $+I$ grp

* Inductive effect of H is taken to be zero (neither $+I$ nor $-I$)

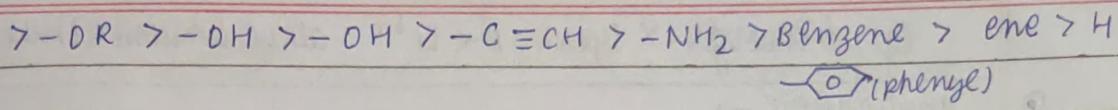
-I effect series -

acc to power -



classmate

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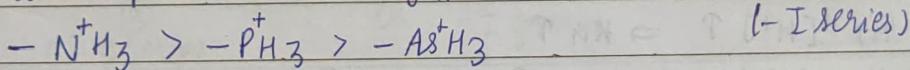
Trick -

ma farhan ma gistik Shahrukh na himesh na omnipuri salman
 $-N^+F_3 > -N^+R_3 > -S^+R_2 > -N^+H_3 > -NO_2 > -SO_3^-$

► cyna ali ki car main father collector Beta inspector
 $-CN > -CHO > -COOH > -F > -Cl > -Br > -I$

aur alcohol ki mummy alkyne nhi hai Benzene ene hai
 $> -OR > -OH > -C\equiv CH > -NH_2 > \text{O} > \text{ene} > H$

* from top to bottom in grp, E.N ↓ \Rightarrow -I power ↓



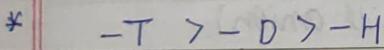
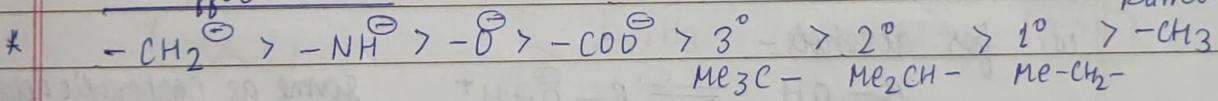
(-I series)



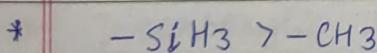
+ I effect series -

acc. to power

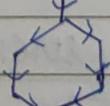
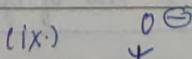
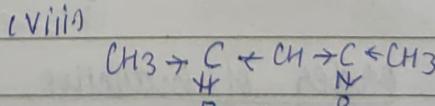
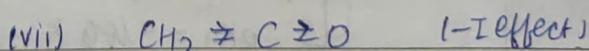
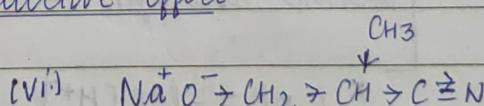
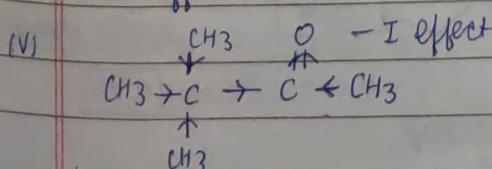
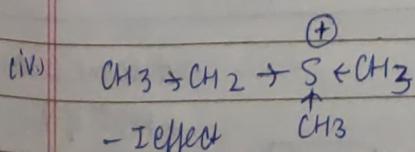
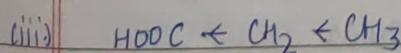
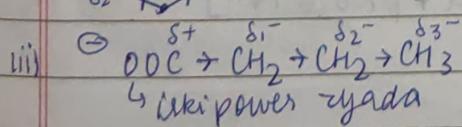
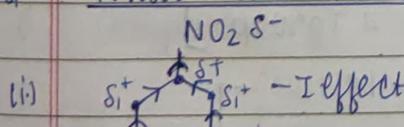
super primary



[+ I effect series]



Q. Draw the direction of inductive effect -

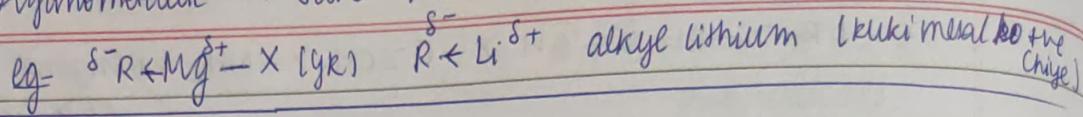


(+I effect)

* Alkyl groups are usually $+I$ groups, but can act as $-I$ groups in organometallic compounds.

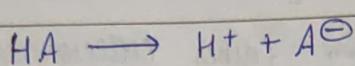
classmate

Organometallic \rightarrow Jaha \uparrow mhal se c Jada ho.



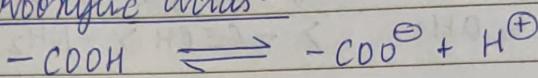
Q. applications \rightarrow

① To compare acidic strength of aliphatic carboxylic acids & alcohols (aliphatic \rightarrow Jisme benzene ring nahi)



more is A^- anion state, more acidic HA.

(i) for carboxylic acids -



$K_a \rightarrow$ dissociation constant

$$K_a \propto [\text{H}^+]$$

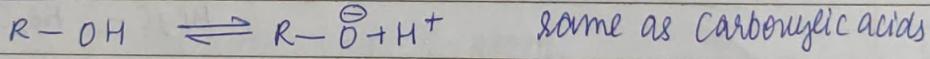
more is COO^- anion state, the acidic strength T.

$$(ii) [\text{H}^+] \uparrow \Rightarrow K_a \uparrow$$

$$(iii) \text{stability of anion} \uparrow \Rightarrow K_a \uparrow$$

[* acidic strength $\uparrow \Rightarrow [\text{H}^+] \uparrow \Rightarrow [\text{OH}^-] \downarrow$]
 $\text{pH} \uparrow, \text{pOH} \downarrow, K_a \uparrow \Rightarrow pK_a \downarrow, pK_b \uparrow \Rightarrow K_b \downarrow$]

(iv) for alcohols -



A.S \propto stability R-O^- (alkoxide anion).

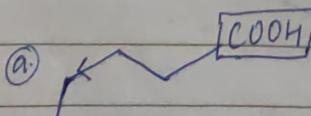
* $\left[\text{acidic strength} \propto -I \text{ group} \propto \frac{1}{+I \text{ group}} \right]$

* $\left[\text{pH} = -\log [\text{H}^+], \text{pH} + \text{pOH} = 14 \right]$
 $\left[pK_a = -\log K_a, pK_a + pK_b = 14 \right]$

* order of inductive effect -

distance $>$ no. of groups $>$ power

Q. Compare acidic strength -



$\hookleftarrow -I \text{ group}$



$\hookleftarrow -I \text{ group}$

d same, n same
power of $\text{NO}_2 > \text{CN}$

acidic strength \rightarrow

$$[a > b]$$

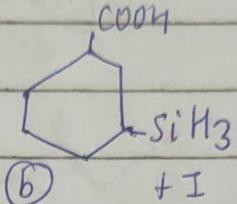
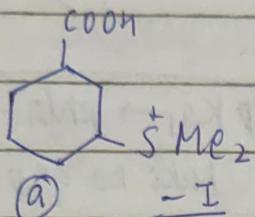
Q7 compare $pK_b \rightarrow$

$pK_b \propto \frac{1}{K_b} \propto K_a \propto A \cdot S.$

$pK_b \propto \frac{1}{K_b}$

$A \cdot S \uparrow \Rightarrow pK_b \uparrow$

$$pK_a \propto \frac{1}{K_b}$$



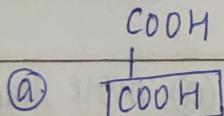
$$A \cdot S \Rightarrow a > b$$

$$pK_b \Rightarrow a > b$$

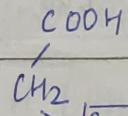
* Dicarboxylic acids -

Q. Compare K_{a1} values of -

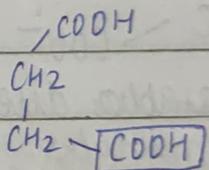
[OMSGAP]



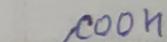
oxalic acid



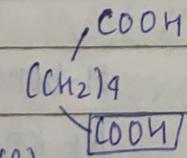
malonic acid



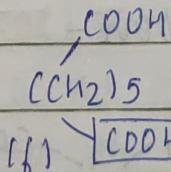
succinic acid



glutaric acid



adipic acid



pimelic acid

to compare K_{a1} values,

8th me seek H^+ nikalo

Jobek me \rightarrow urme se H^+ nikalo

\rightarrow distance $\downarrow \Rightarrow -I \downarrow \Rightarrow A \cdot S \downarrow \Rightarrow K_{a1} \downarrow$

and durro Vala COOH

$\therefore K_{a1}$ values \rightarrow

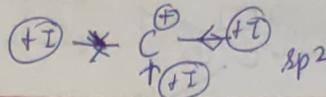
as $-I$ grp of ~~rest~~ rest.

$$a > b > c > d > e > f$$

② To compare stability of intermediates \rightarrow carbocations, carbanions & free radicals

classmate

Case - 1 : carbocations -

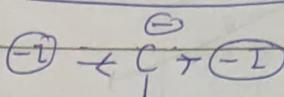


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for carbocations :

$$\text{stability} \propto +\text{I effect} \propto \frac{1}{-\text{I effect}}$$

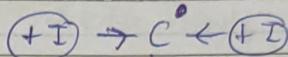
Case - 2 : carbanions



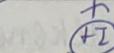
for carbanions :

$$\text{stability} \propto -\text{I effect} \propto \frac{1}{+\text{I effect}}$$

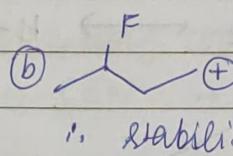
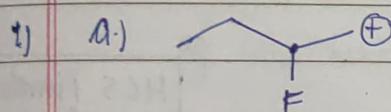
Case - 3 : free radicals



Stability same as carbocations

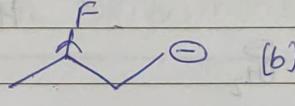
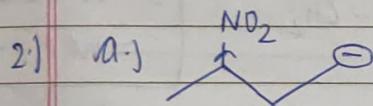


Q. compare stability -



as distance $\text{r} \rightarrow -\text{I effect}$
stability of carbocation \uparrow

\therefore stability $\rightarrow [b > a]$



$d \rightarrow \text{same, } m \rightarrow \text{same}$
 $\text{power of } \text{NO}_2 > \text{F}$

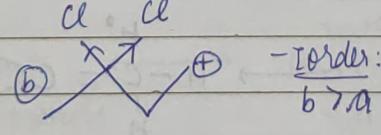
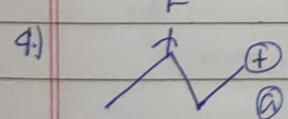
stability order $\rightarrow a > b$

as $-\text{I effect} \rightarrow \text{carbanion} \uparrow$



order $\rightarrow b > a$

as $d \rightarrow +\text{I effect}$
carbocation \downarrow



$-\text{I order: } b > a$

$m \rightarrow \text{diff}$

stability $\rightarrow a > b$

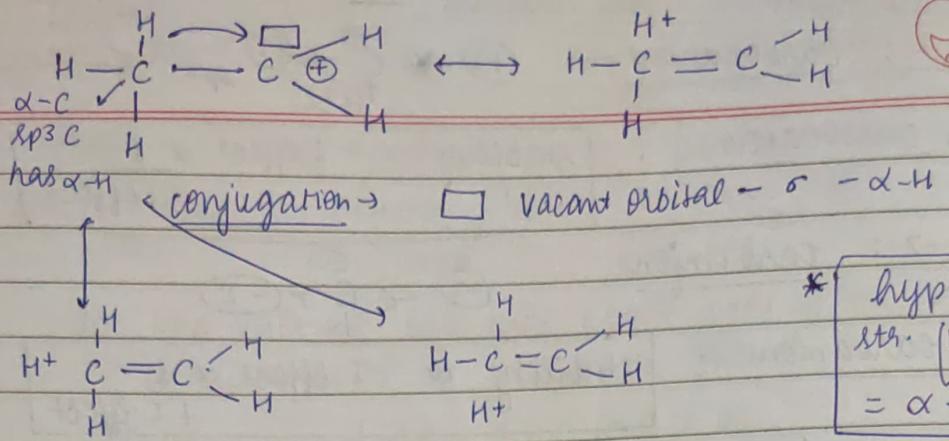
Hyperconjugation

→ when a single C-H bond of sp^3 hybrid C is in conjugation with π -bond (in alkenes) or half-filled p orbital (free radical) or vacant p orbital (in carbocations), then the bond pair e⁻ ms of C-H bond overlap with adjacent π bond or half filled p orbital or vacant p orbital. This phenomenon is called hyperconjugation.

→ also known as anchimeric effect or baker nathan effect or no bond resonance.

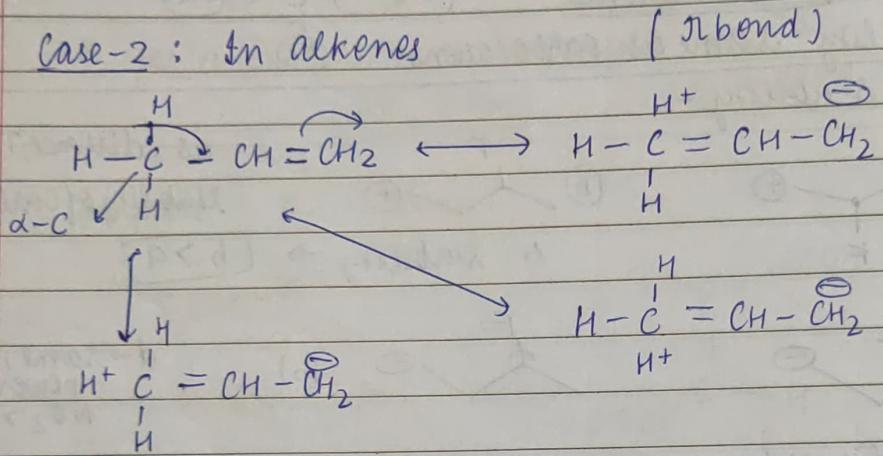
→ Condition \rightarrow at least one α -H & sp^3 α -C

Case-1: In carbocation \rightarrow (vacant p orbital)



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Case-2: In alkenes



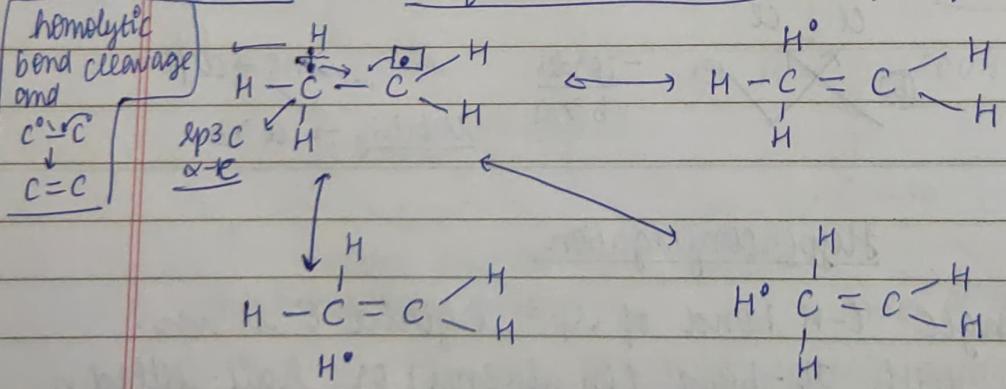
(π bond)

$\left[\begin{array}{l} \text{nbond weak thm's} \\ \text{tch w/o tatega} \end{array} \right]$

HCS (involving
 C-H bond breaking)
 $= \text{no of } \alpha\text{-H}$

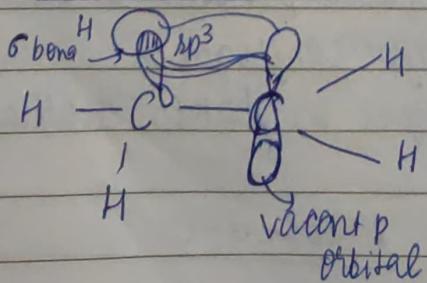
* Ek baar me ek $\alpha\text{-H}$ hi hyperconjugation show kr skta h.

Case-3: In free radicals \rightarrow (half-filled p orbital)



Orbital overlapping approach —

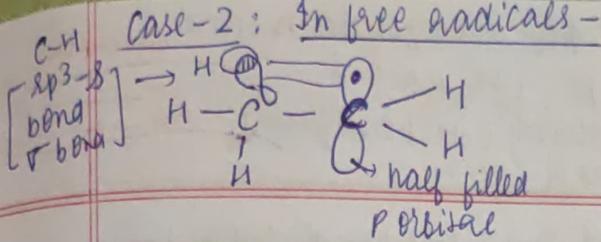
Case-1: In carbocations —



hyperconjugation due to.

$\left[\begin{array}{l} \text{r-vacant p orbital} \\ \text{C-H} \\ \text{sp}^3-\text{s} \end{array} \right]$

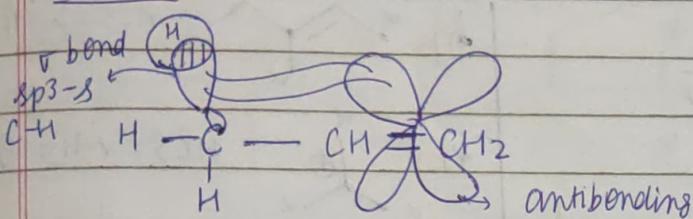
overlapping



$\left[\begin{array}{l} \text{C-H} \\ \text{sp}^3-\delta \end{array} \right] \text{ half filled p } \left[\begin{array}{l} \text{C-H} \\ \text{sp}^3 \end{array} \right] \text{ overlapping}$

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Case-3 : In alkenes



π^* orbital formed when π bond formed.

$\left[\begin{array}{l} \text{C-H} \\ \text{sp}^3-\delta \end{array} \right] - \pi^* \left[\begin{array}{l} \text{C-H} \\ \text{sp}^3 \end{array} \right] \text{ overlapping}$

hyperconjugation due to

* $\text{C}\equiv\text{C}$, $\text{C}=\text{O}$ and $\text{C}\equiv\text{N}$ does not show hyperconjugation because π^* orbitals (anti-bonding orbitals) have higher energy as for overlapping, comparable energy needed.
eg $\text{CH}_3-\text{CH}=\text{O}$, $\text{CH}_3-\text{C}\equiv\text{N}$ \rightarrow no hyperconjugation

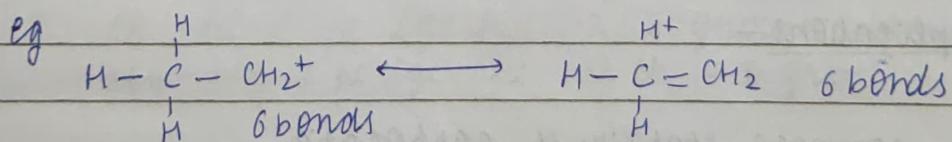
* $\sigma - \sigma^*$ overlapping in conformers (hyperconjugation)

① Types of hyperconjugation -

(all cases of $+\text{H}$ effect)

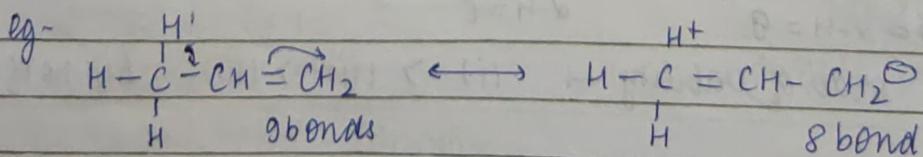
1) Isovalent hyperconjugation \rightarrow in carbocation & free radicals.

\rightarrow All H.C.S have same no. of bonds.

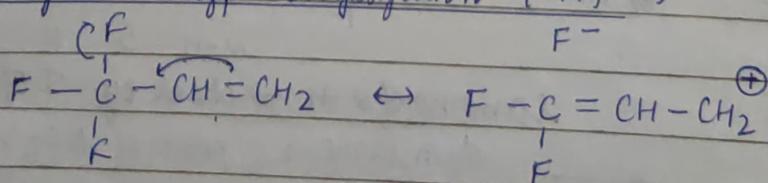


2) Sacrificial hyperconjugation \rightarrow in alkenes

\rightarrow at least one H.C.S has less no. of bonds.



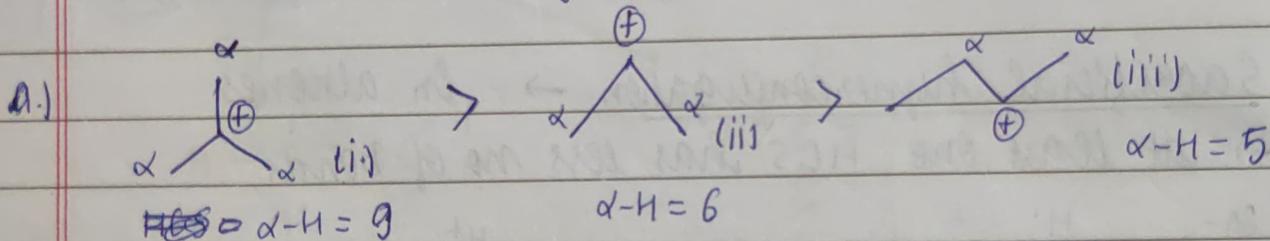
3) Negative hyperconjugation (-H) \rightarrow



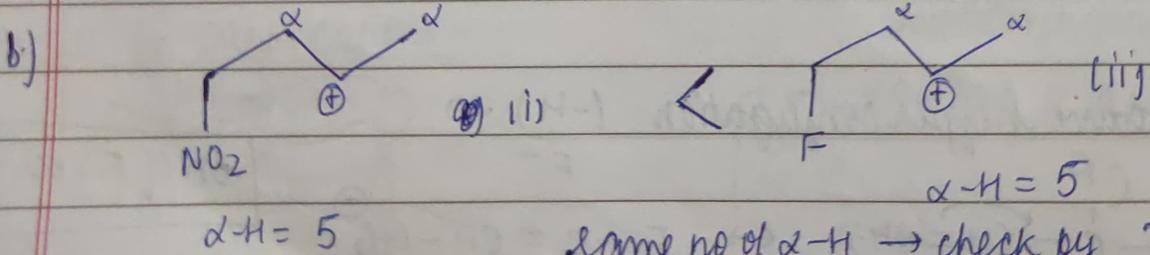
en of F > en of C

Applications -

① To compare stability of carbocation -



order of stability \rightarrow (i) $>$ (ii) $>$ (iii) by no of α -H



Some no of α -H \rightarrow check by I effect
dim same \rightarrow power of $\text{NO}_2 > \text{F}$ (-I group)

Hence: $\boxed{(\text{ii}) > (\text{i})}$ \leftarrow as - I⁺ \Rightarrow carb⁺ stability \downarrow .

* Hyperconjugation effect > inductive effect

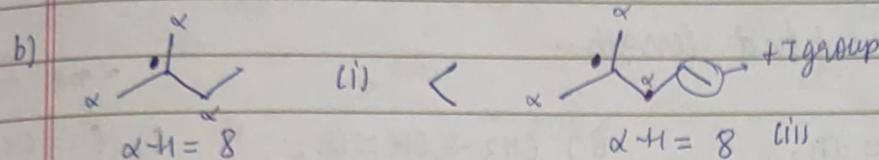
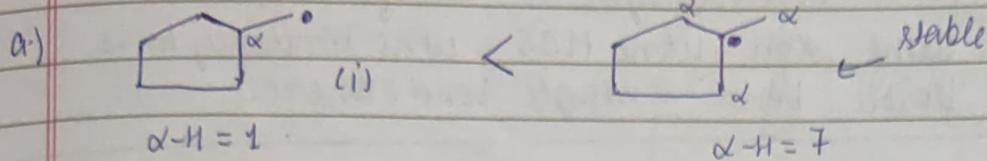
* Stability \propto no of α -H (for carbo \oplus , free radicals, alkenes)

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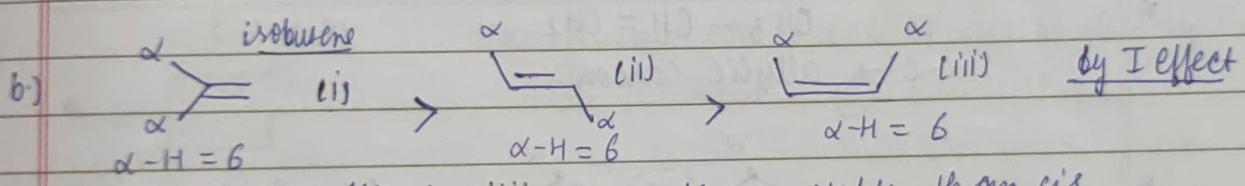
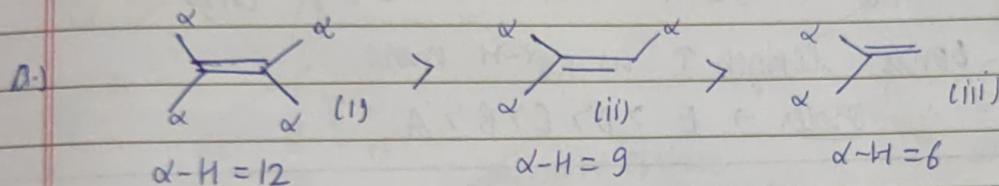
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② To compare stability of free radical -



same no of α -H
check by I effect.
 $\text{as} + \text{I} \rightarrow \text{e}^- \text{ given}$
 \Rightarrow free radical stable.

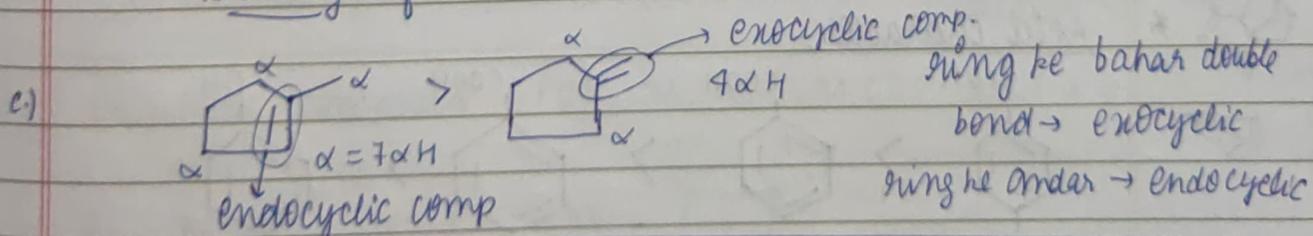
③ To compare stability of alkenes -



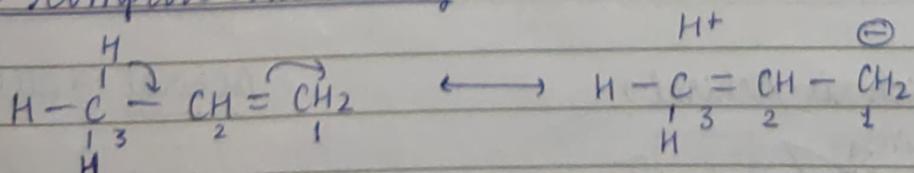
(iii) $>$ (ii) as trans stable than cis

[* ek hi C pe lge hue 2+I groups dominates over
alg-alg C pe lge hue ek ek + I grp]

\therefore Stability of isobutene $>$ trans but-2-ene $>$ cis 2-butene



④ To compare bond-length -



due to hyperconjugation

* C-H bond is longer than expected.

* bond length of C₁-C₂ is more than expected & bond length of C₂-C₃ is less than expected.

* Bond length \rightarrow $C \equiv C < C=C < C-C$

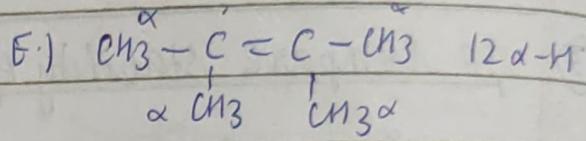
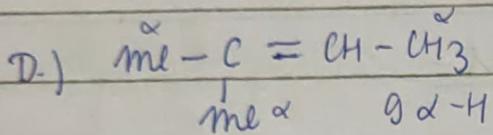
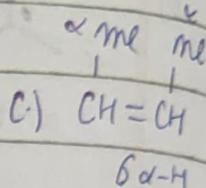
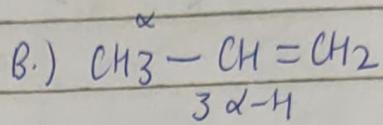
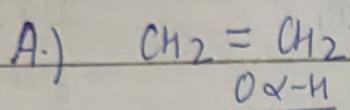
* agar bond single to double Jane chahga, bond length \downarrow and if double \rightarrow single, bond length \uparrow .

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* for $[C=C$ bond length \propto no. of α -H]

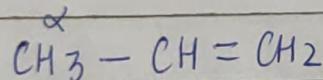
as Jisme α -H, utne HCS, whi tendency h is double bond \rightarrow single bond Janeke.

Q. Compare $C=C$ bond length -



bond length \uparrow as α -H more.

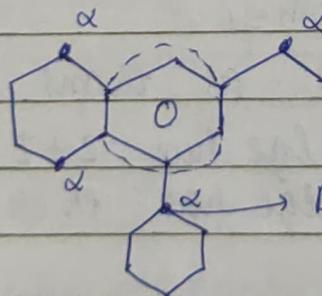
\therefore order $\rightarrow E > D > C > B > A$



$\alpha-H = 3$

α -C \rightarrow allylic carbon

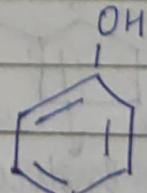
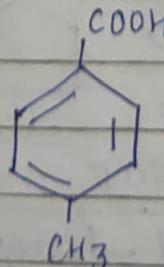
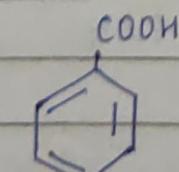
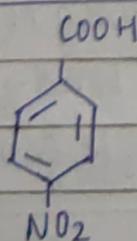
α -H:
H attached to
benzylic C



$\alpha-H = 7\alpha-H$

for benzene
 α -C \rightarrow benzylic C
(benzene directly
attached α -C)

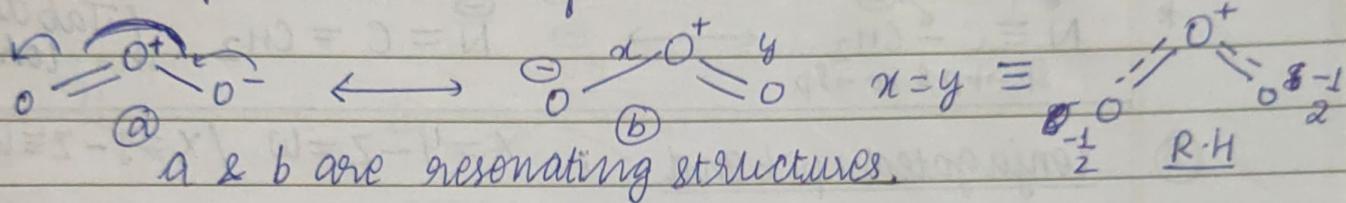
* Acid character -



CH_3

Resonance effect or mesomeric effect

1. When all properties of molecule can not be explained by a single Lewis structure, then two or more than structures are required to explain behaviour of molecule \rightarrow then resonance.



2. Various structures are called Resonating structure (R.S.).
3. R.S. are hypothetical but must be valid Lewis structures.
4. Intermediate structure b/w R.S. is called resonance hybrid (R.H.).
5. R.H. is actual structure (real) & most stable because of lowest energy (among R.S.).
6. R.S. contributes to R.H. according to stability & more is the R.S. stable, more is its contribution to R.H.
7. R.S. which contributes most is known as most contributing or most stable R.S. (M.C.R.S)

- Condition to show resonance -

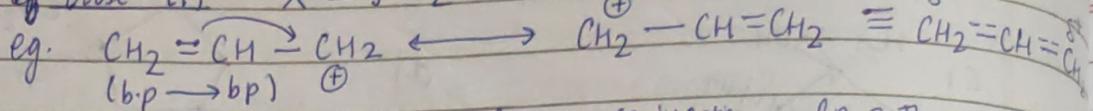
1. planarity \rightarrow All atoms participating in resonance should be in same plane.
OR \rightarrow participating orbitals should be in same plane as atoms participating \rightarrow orbital overlapping.

2. Conjugation →

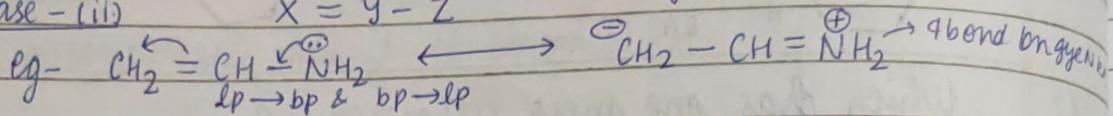
Types → ① Allylic system → $X = Y - Z$
 where Z can be radical, ^{+ve or -ve charge} lp or ^{vacant orbital} lp .

where X, Y, Z may be same
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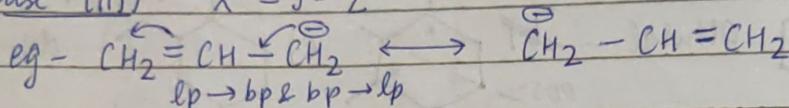
Case - (i) $X = Y - Z^\oplus$



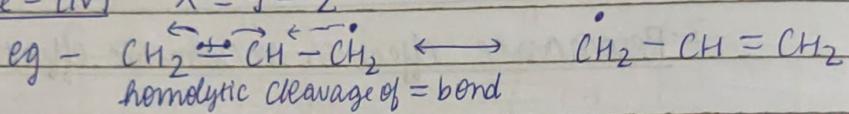
Case - (ii) $X = Y - Z^\ominus \rightarrow \text{lp}$ $\xrightarrow{\text{conjugation}} \text{lp} \sigma \pi$



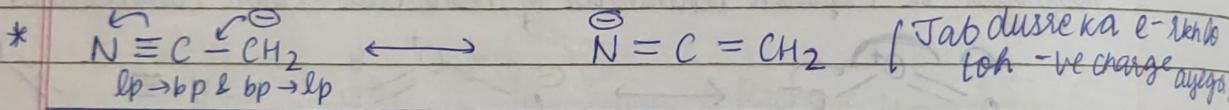
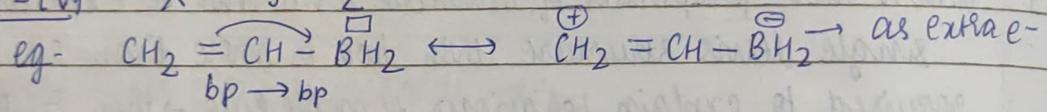
Case - (iii) $X = Y - Z^\ominus$



Case - (iv) $X = Y - Z^\bullet \rightarrow \text{free radical}$



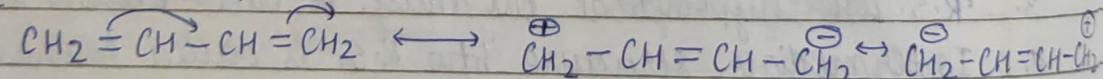
Case - (v) $X = Y - Z^\square \leftarrow \text{vacant orbital}$



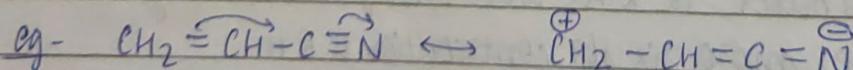
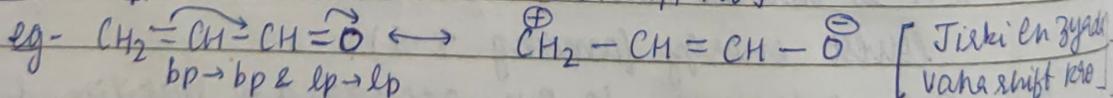
2. Conjugated pi bond : $X = Y - Z = W$ / $X = Y - Z \equiv W$ / $X \equiv Y - Z \equiv W$

Case - (i) : non polar π, π bond - (en diff mhi ho)

eg. $\text{bp} \rightarrow \text{bp} \& \text{bp} \rightarrow \text{lp}$

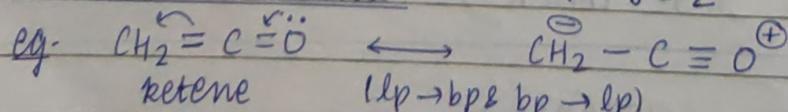


Case - (ii) : polar $\pi - \pi$ bond - (en diff ho) →



3. Cumulative π bond -

$X = Y = Z$



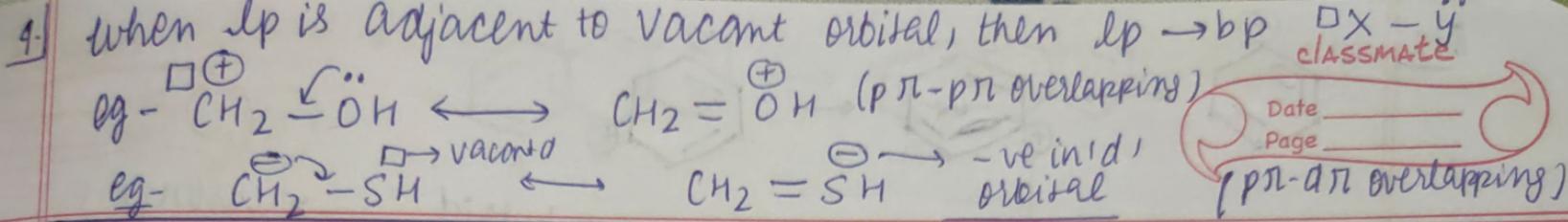
{ yaha O ke 4 paliye shift kroye kuki O ke 10 bonding lehe

eg. $\text{N} = \text{N} = \text{N} \longleftrightarrow \text{N} \equiv \text{N} - \text{N}^2\ominus$

azide

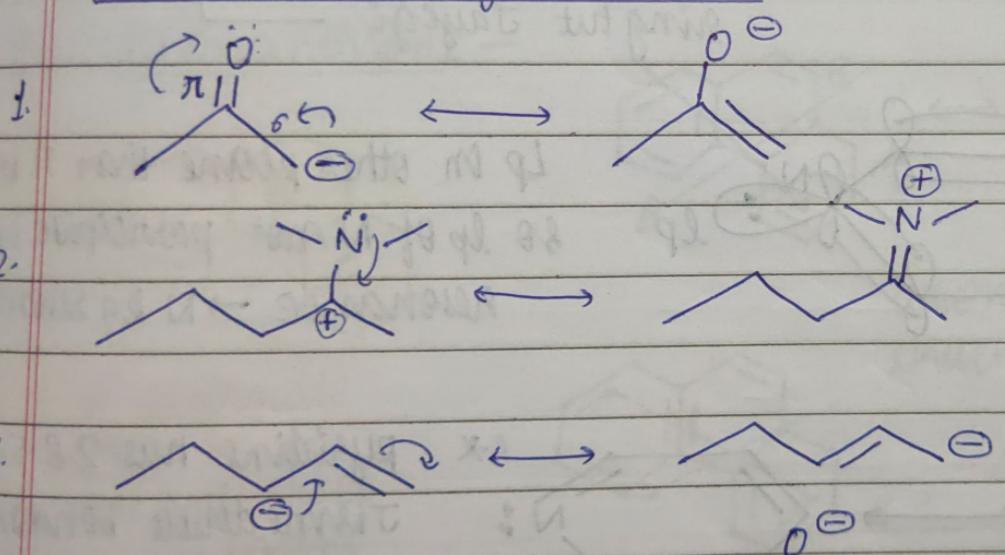
ek \downarrow -ve phle setha dusra aur agya

$\text{lp} \rightarrow \text{lp} \& \text{lp} \rightarrow \text{lp}$

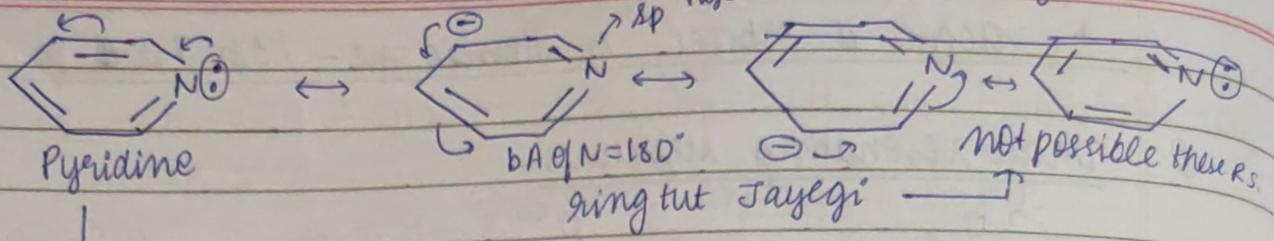


* vacant d orbital in atomic no - 13 to 79

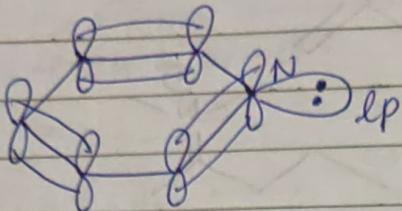
Q. Draw resonating structures -



* 13.



also



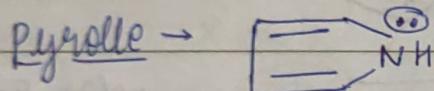
correct R.S.

lp in other plane than π bonds
so lp of N not participate in resonance \rightarrow N ka resonance ni hoga

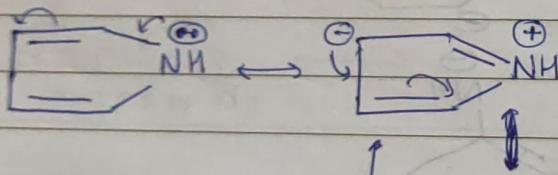
* Pyridine has 2 R.S.

Jisme double bond shift hoga
but N doesn't participate in resonance.

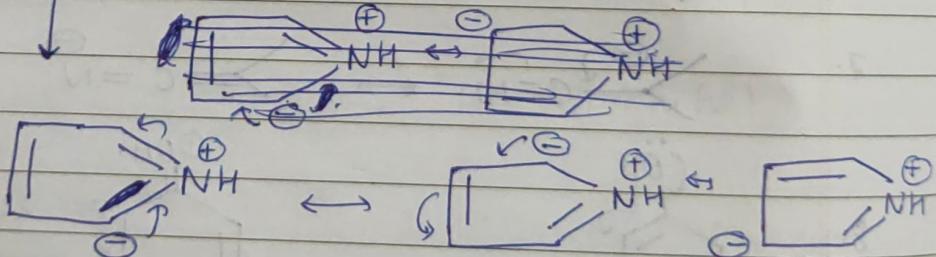
14



* Pyrrole me N ka lp resonance me ja skta h.



* also Kewal π & π resonance possible pr puriing cover ni negium.



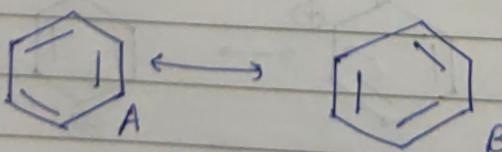
Q.

Draw neutral R.S. (for fused rings)

Benzene ke 2 RS possible A & B

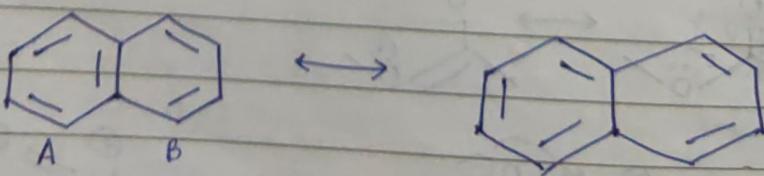
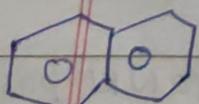
1.

Benzene -



2 R.S.

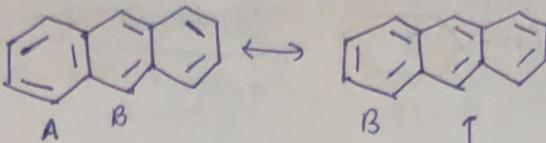
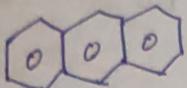
2. Napthalene -



3 R.S.

Yahan phle 1st ring ko A bnao
ao phis dusri me alternate
double bonds lgao, then 2nd ko B bnao
& last me second ko A bnao

3.

Anthracene →

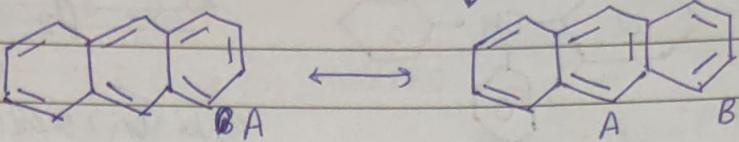
classmate

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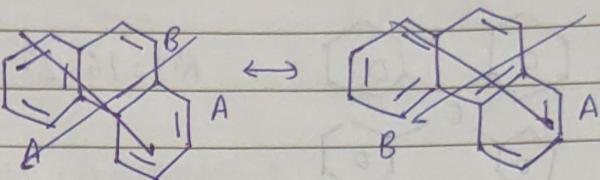
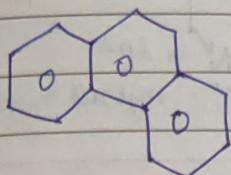
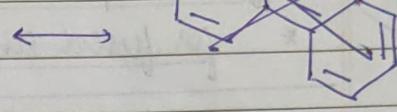
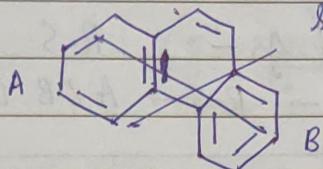
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sanis rings re
ek ekbar
A & B ana
chuye

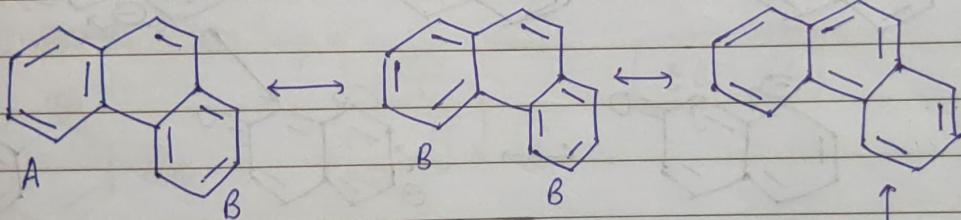
4.R.S.



4.

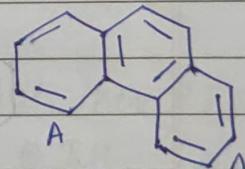
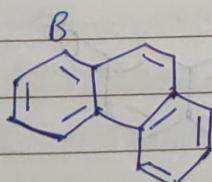
Phenanthrene -wrong X
structures

alternate
double bonds
pure cycle meet
bar me lgami
ring me ghulna impnih.

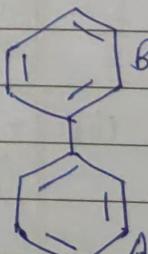
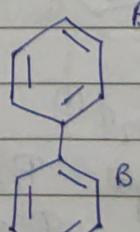
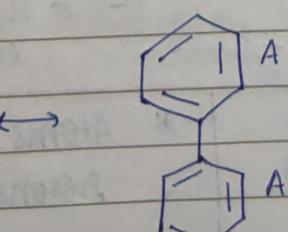
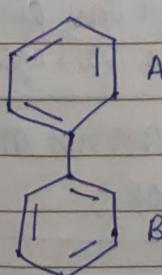
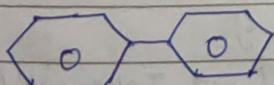
Eight arms =

A

B

5.R.S.
drawn(for non-fused
rings → connected
valirings)

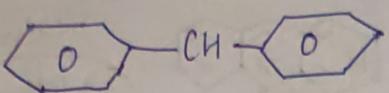
5.



4.R.S.

4aha bina bnoye combination
dethme h independent honge
combinations.

6.

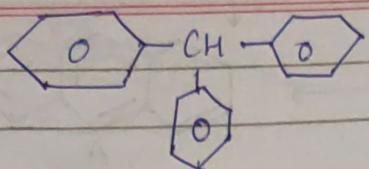


Combinations \rightarrow A B, AA
B A, BB
R.S.

classmate

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7.

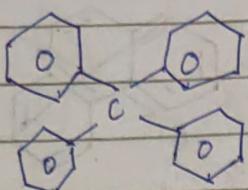


$$R.S = 3P_2 = 3! = 6$$

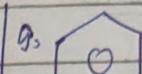
~~$$R.S = 2 \times 2 \times 2 = 8 R.S.$$~~

Ruki ruki 2 choice.

8.



$$R.S = 16 = 2^4$$



$$R.S = 2$$

$\text{N} \rightarrow \text{sp}^2$
hybrid

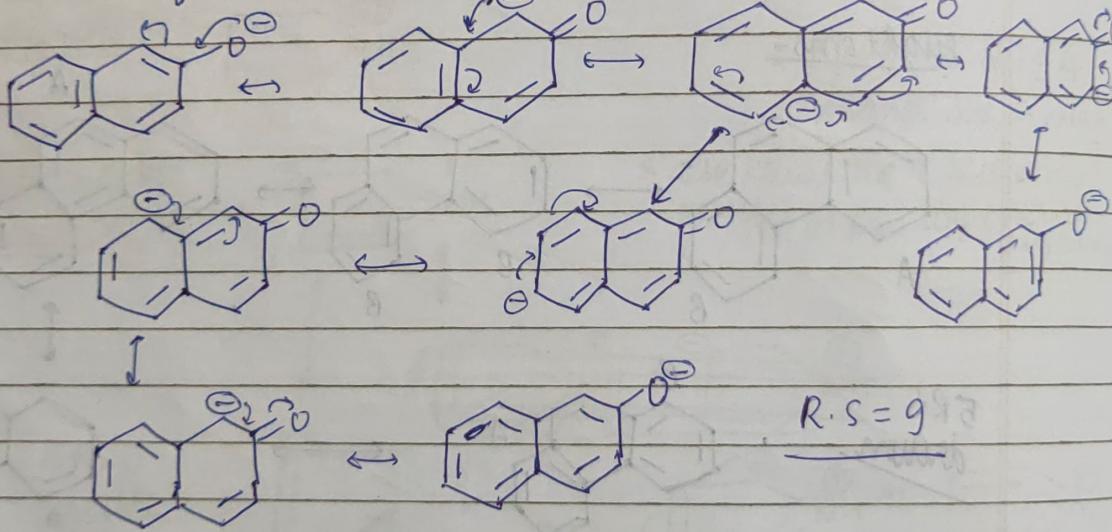
neutral
R.S.

* for independent rings - R.S. = 2^n $n \rightarrow$ no. of rings

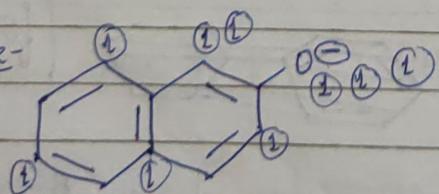
* for fused rings - R.S. \rightarrow A & B Combinations se -

Q. DRAW R.S. of -

(i)



Trick -

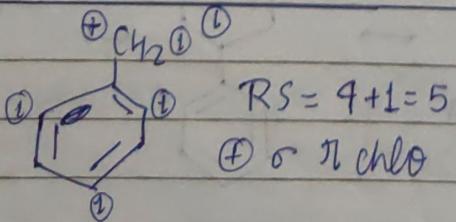


$$R.S = 9$$

~~①~~ \rightarrow Jaha - ve Charge aya

\ominus σ π chalte Jao aur Jaha π
end ho vaha aya - ve aya

(ii)

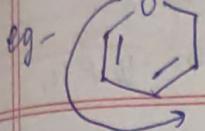


$$R.S = 9 + 1 = 5$$

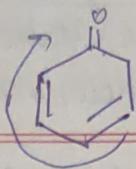
\oplus σ π chlo

* Atoms cannot move in resonance.

Extended conjugation - Job continuity no conjugation



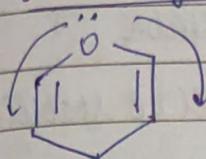
lp on σ & π



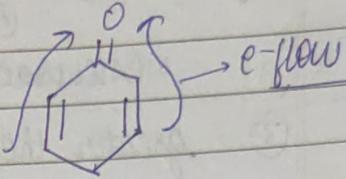
lp on σ

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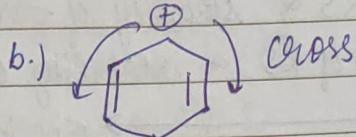
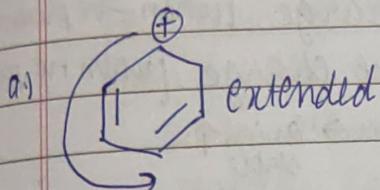
Cross conjugation - Job 2 diff sides no



lp on σ &
lp on π
both sides



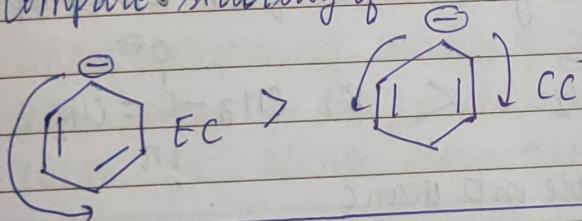
Q. find extended & cross conjugation?



(EC)

* extended conjugation has more priority than cross (CC) conjugation due to high resonance energy of EC.

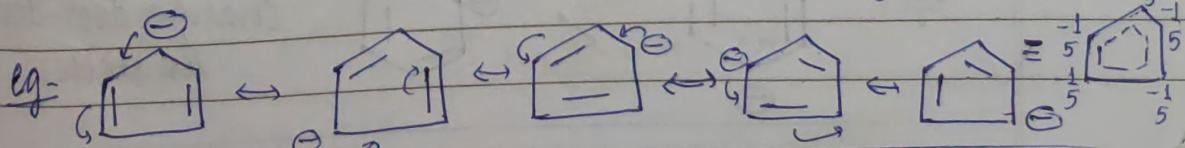
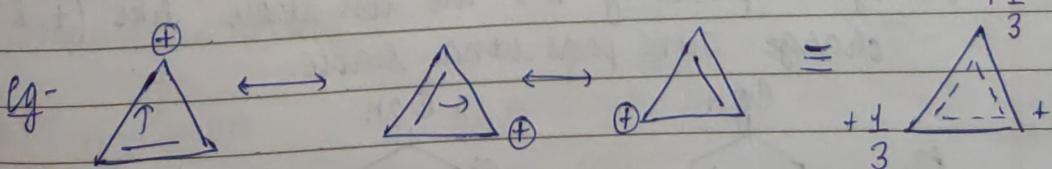
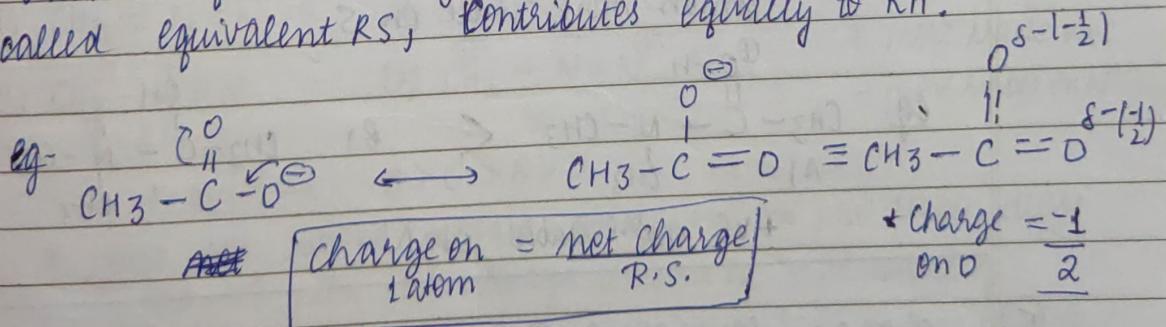
Q. compare stability of -



EC > CC

equivalent resonating structures -

when PE of resonating structures are equal, then RS are called equivalent RS, contributes equally to RH.



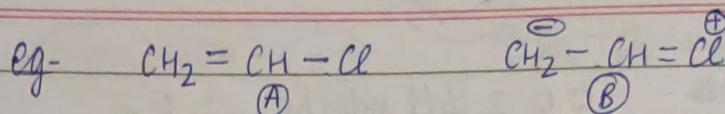
① Stability of resonating structures -

- ① neutral R.S. is more stable than charged R.S.
② more is the R.S. stable, more is the contribution to R.H.

classmate

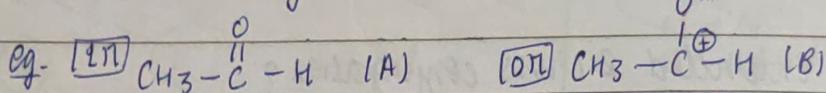
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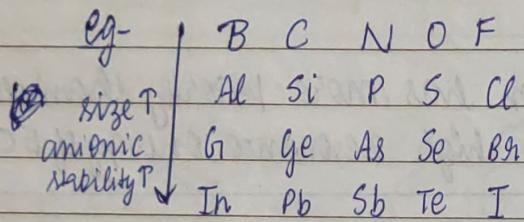
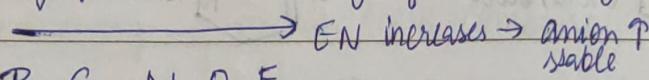
neutral > charged $\Rightarrow A > B$ stable

- ③ greater the no of π bonds, higher will be stability.
stability \propto π bonds.



$A > B$
ssable

- ④ Stability of RS \propto stability of -ve charge (when -ve present)
& stability of RS \propto stability of +ve charge (when +ve present)

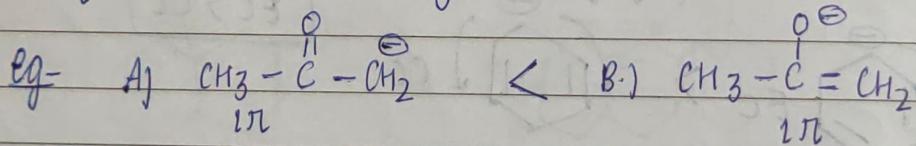


for anion stability -

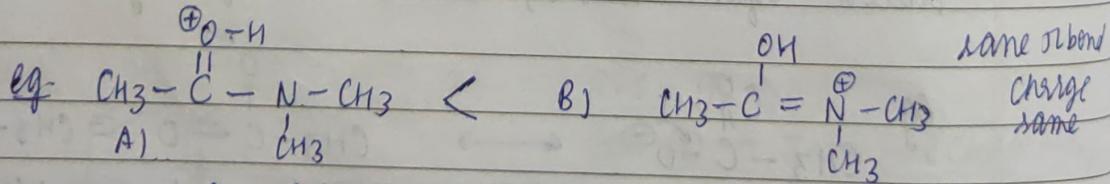
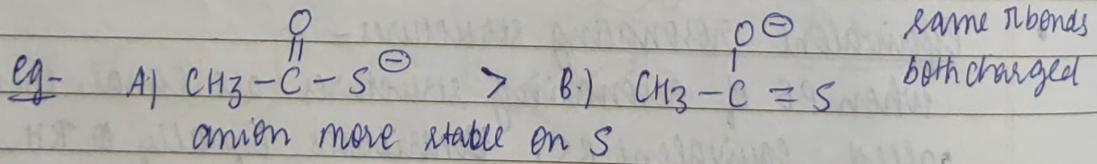
left to right \rightarrow T [en T]

top to bottom \rightarrow P (size P)

* for the ion, stability decreases from 1 to 2 & top to bottom.

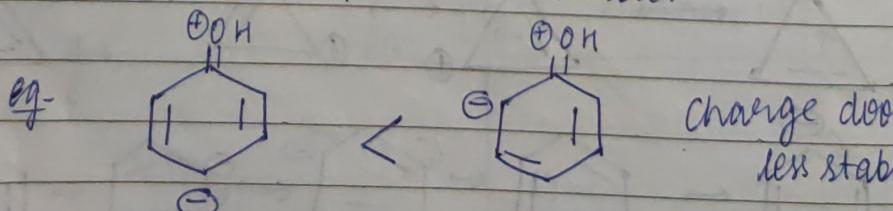


anion more stable on O than C.



+ve more stable on N

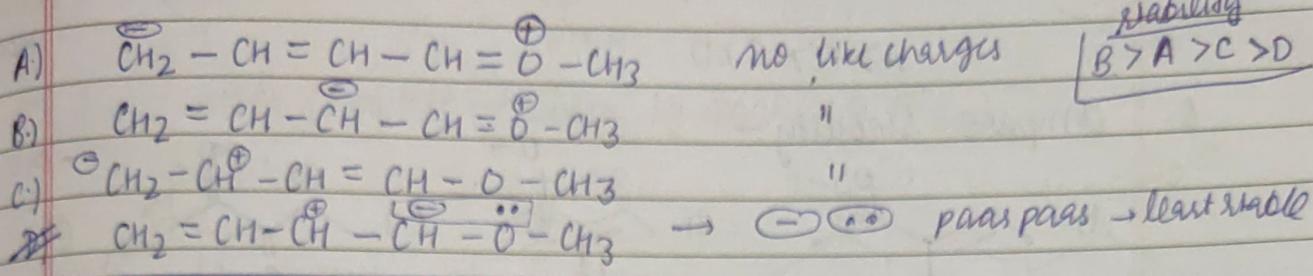
5. charge separating R.S are less stable like $(+ & -)$ or $(+ & +)$
charge jitne parsa utna stable.



⑥ like charges on adjacent positions are least stable. classmate
 $(\oplus, \oplus), (\ominus, \ominus), (\ominus, \oplus), (\oplus, \ominus)$ ye groups paas paas toh least stable.

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Q. Which is least stable R.S? \rightarrow check for rule - 6



* To compare stability of R.S -

then follow rules in order $\rightarrow ① \rightarrow ③ \rightarrow ④ \rightarrow ⑤ \rightarrow ⑥$

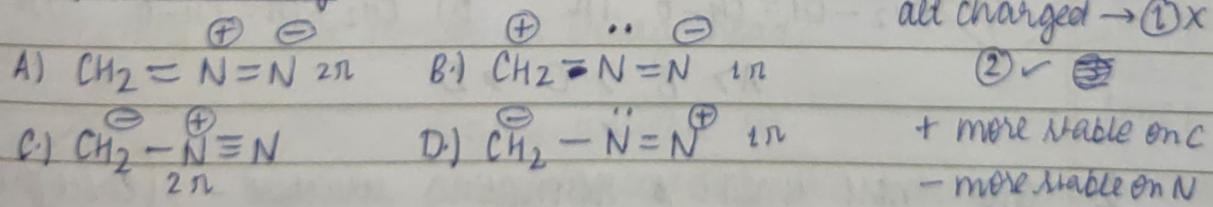
when asked least stable R.S

directly apply rule ⑥, if invalid, then go for $① \rightarrow ③ \rightarrow ④ \rightarrow ⑤$

* when asked most unlike structure, then check if octet is expanded or not, [for 2nd period elements \rightarrow never O^{2-}]
 if octet complete, then check by making R.S.

* when comparing stability of anion - (opp for stability of cation)
 then when go along period \rightarrow check by EN (inc from left \rightarrow right)
 when go along group \rightarrow check by size (inc from top to bottom)

Q. Compare stability -

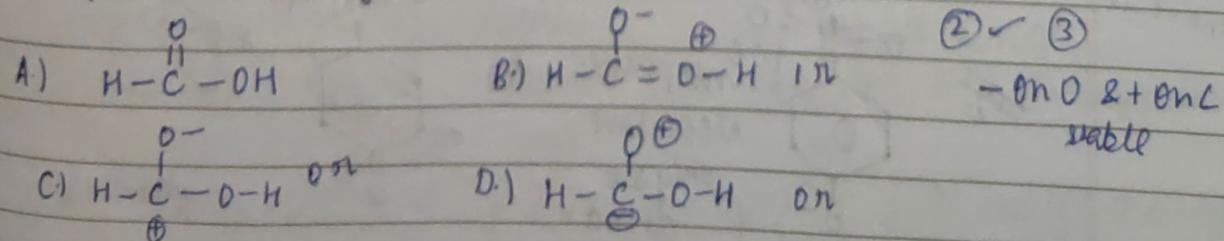


" order $\rightarrow A > C > B > D$

* Jab +ve aur -ve me fasto, ek me +ve part stable, dusre me -ve vala, toh always compare by -ve stability.

Q. Compare stability -

neutral stable \checkmark

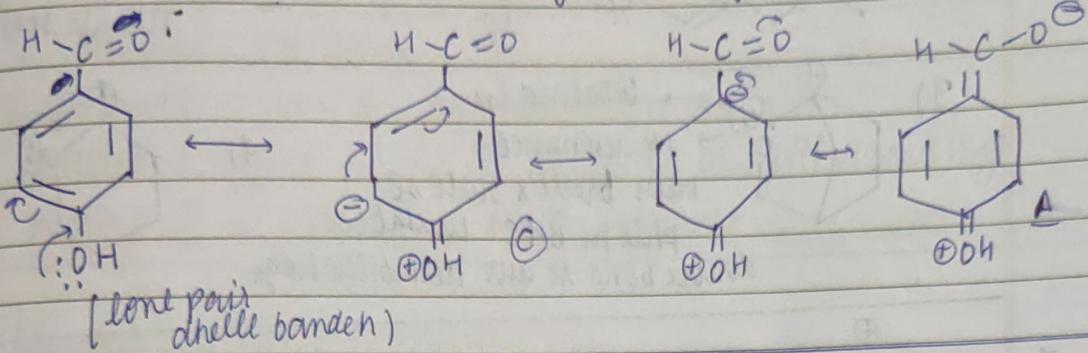


$A > B > C > D$

Q. The most unlike representation of resonance structure of p-hydroxy benzaldehyde?

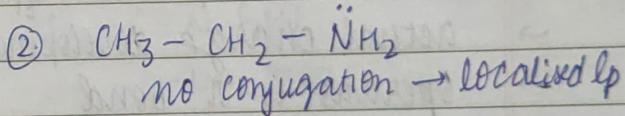
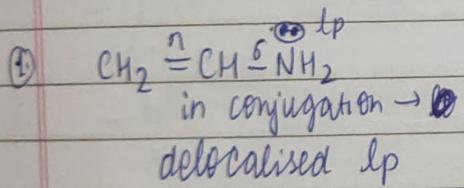
Ans.

Octet complete \rightarrow check by making R.S.



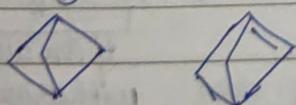
- ① Delocalised lone pair \rightarrow If lp participates in resonance.
 - ② Localised lone pair \rightarrow If lp doesn't participate in resonance.

0. Identify localised & delocalised lp.



① Bredt's rule-

- planarity is not possible at bridge head C.



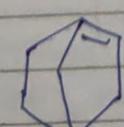
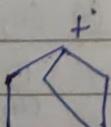
highly unstable str.

as bridgehead see the desire plane me Judah.

It can never be planar as yaha

sp^2 hybrid ho Jayega \rightarrow str. planar \rightarrow not possible.

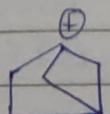
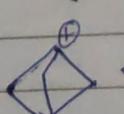
[Hence, bridge head C khali bhi sp² nahi ho skta h]



highly
unstable

(for all rings
 $\text{sp}^2 \text{ B} \text{H} \text{C} \rightarrow$ ring unstable)

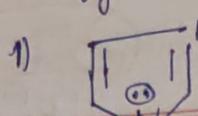
Stability \rightarrow





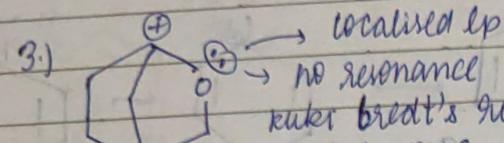
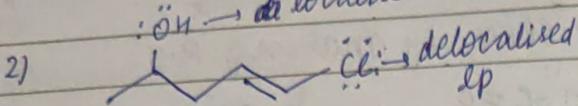
as no of C increasing
 ↳ stability of
 sp^2 B H C str ↑

Q) Identify delocalised & localised lp.



1) $\text{N} \rightarrow \text{sp}^2$ hybrid N
iska lp sp^2 hybrid orbital h
to participate in hkr shka h
(localised lp)

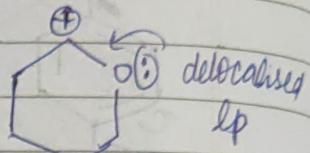
2) $\text{O} \text{H} \rightarrow$ in conjugation
(delocalised lp)



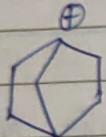
Kekulé Bredt's rule se
phle hi BHC unstable
double bond se aur destabilise hogा

agar delocalised lp h
toh ek bar me ek hi
jayega, more than one
Nhi Jaisa kia

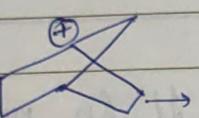
4)



*



\equiv



same str.

Yaha bhi Bredt's rule lgta h

- Mesomeric effect or resonance effect -
- permanent effect.
- distance independent effect
- actual charge development
- Operates to π bond

Mesomeric effect

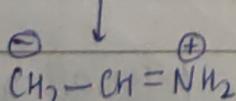
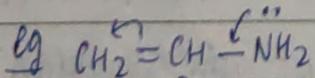
+M effect

If an atom or grp donates
p-orbital e⁻s to conjugation

(on triple bond
double bond or
benzene ring)

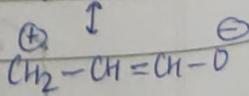
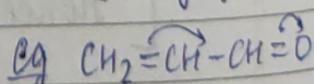
-M effect

If an atom or group
withdraws p-orbital e⁻
from double bond or
benzene ring



$-\text{NH}_2 \leftrightarrow +\text{M grp}$

(e⁻ flow away
from grp)



(e⁻ flow towards grp)

$-\text{CHO} \rightarrow -\text{M group}$

classmate

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* double bond ya benzene se Jude hue phle atom pr
 → agr. lp h toh \rightarrow +M group [eg- NH_2 , $-\text{OH}$]
 agr. double/triple bond toh \rightarrow -M group (e-flow towards gap)

* resonance ka type \rightarrow mesomeric effect or resonance effect.
 * resonance & (M & R effect) diff.
 resonance ki vajah se jo effect M or R effect.
 → resonance may be mesomeric but mesomeric always resonance.

* Resonance refers to delocalisation of e^- s.

* mesomeric effect is the e^- donating or withdrawing nature of a substituent due to resonance.

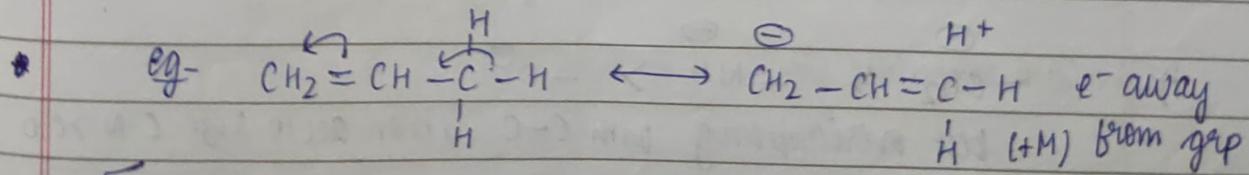
Q. Identify +H or -H group.

1. $-\ddot{\text{O}}\text{H}$	$\text{lp} \rightarrow +\text{M}$	9. $-\text{NH} (+\text{H})$	17. $-\text{C}=\text{O}-\text{OH}$
2. $-\ddot{\text{N}}\text{H}_2$	$\text{lp} \rightarrow +\text{H}$	10. $-\text{O}^- (+\text{M})$	$\text{O}^- -\text{M}$
3. $-\ddot{\text{X}}$	$\text{lp} \rightarrow +\text{M}$	11. $-\text{CHO} (-\text{H})$	18. $-\text{C}=\text{O}-\text{O}-\text{C}$ -M CH_3
4. $-\ddot{\text{N}}\text{HCH}_3$	$\text{lp} \rightarrow +\text{M}$	12. $-\text{C}=\text{O}-\text{R} (-\text{M})$	
5. $-\text{N}-\text{CH}_3$	$\text{lp} \rightarrow +\text{H}$ CH_3	13. $-\text{C}\equiv\text{N} (-\text{M})$	19. $-\text{C}=\text{C}-\text{R}$ $\text{O}^- -\text{M}$
6. $-\text{N}^+=\text{O}$	double bond $\text{O}^- -$ $\text{H}^- -$	14. $-\text{C}=\text{N}-\text{H}_2$ $\text{O}^- -\text{H}$	20. $-\ddot{\text{S}}\text{H}$ $+\text{H}$
7. $-\text{S}-\text{OH}$	$n\text{bond} \rightarrow -\text{H}$	15. $-\ddot{\text{N}}\text{H}-\text{C}=\text{CH}_3$ $(+\text{M})$	21. $-\ddot{\text{O}}\text{R}$ $+\text{M}$
8. $-\text{CH}_2^-$	$+\text{M}$	16. $-\ddot{\text{O}}-\text{C}-\text{R}$ $+\text{H}^- \text{O}^-$	

(due to +H effect)

me

* +M groups - $-\text{CH}_3$, $-\text{CD}_3$, $-\text{CT}_3$, $-\text{CH}_2\text{CH}_3$, $-\text{CH}-\text{me}$



bond energy for isotopes

as mass no $\uparrow \rightarrow$ bET

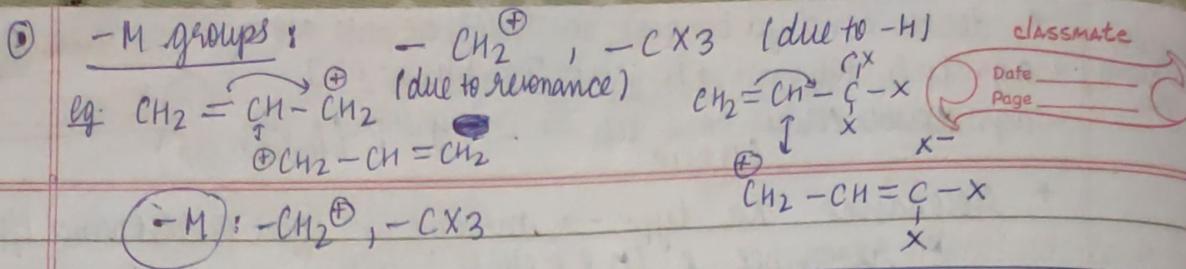
Jiske bET \rightarrow vo Jldinhi

is order of breaking easily.

trega

$\text{CH}_3 > \text{CD}_3 > \text{CT}_3$

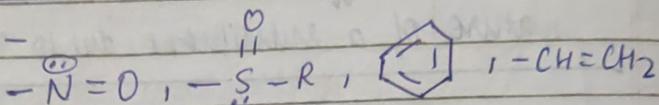
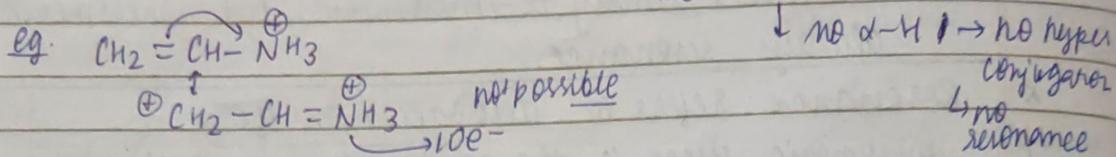
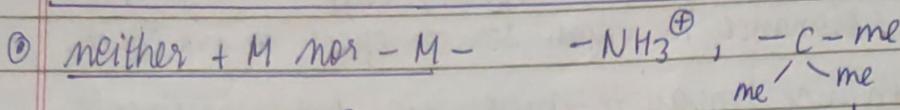
ye asamne
trega.



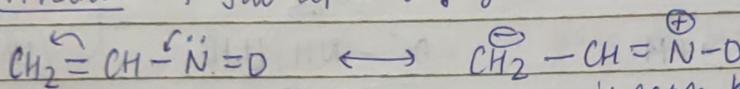
classmate

Date _____

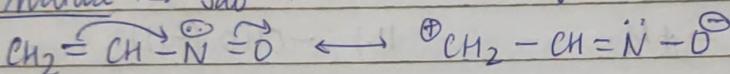
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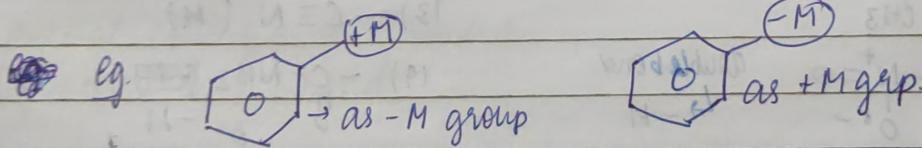
+M nature \rightarrow Jab π se conjugation kare



-M nature \rightarrow Jab π bond se conjugation kare.



Jab E^{\oplus} aye ga tab inka +M nature & $\text{Nu}^{\ominus} \rightarrow$ -M nature.



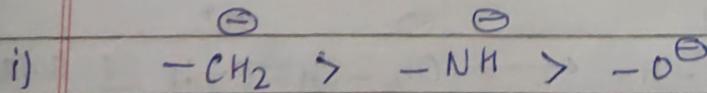
Q. Arrange following groups in decreasing order of +M effect-

* for power of +M effect ~~size~~, check for overlapping of the first atom of grp with C.

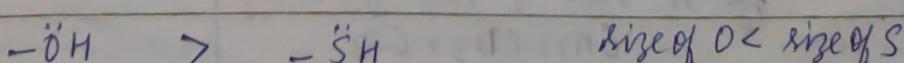
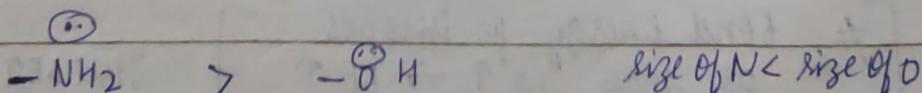
Jiske achi overlapping \rightarrow urha +M effect

(comparable size with C \rightarrow overlapping achi)

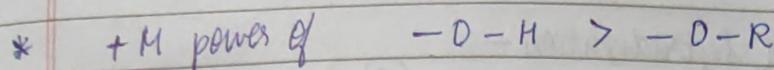
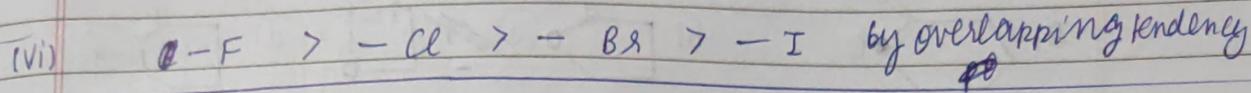
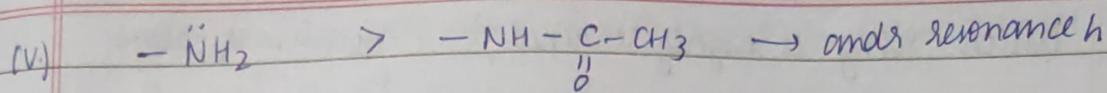
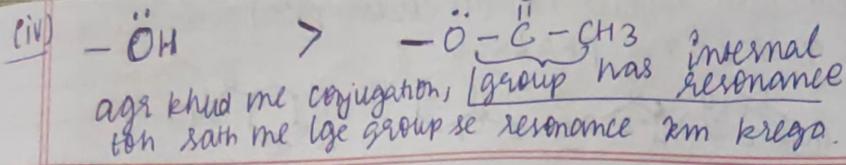
size
 $\text{C} > \text{N} > \text{O} > \text{F}$



best overlapping with C-C, then acc to size $\text{C}-\text{N} > \text{C}-\text{O}$



$\text{C} \leftarrow \text{O} \rightarrow$ better overlapping



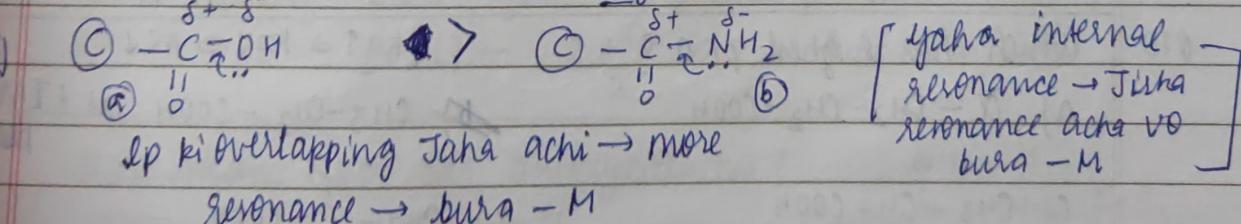
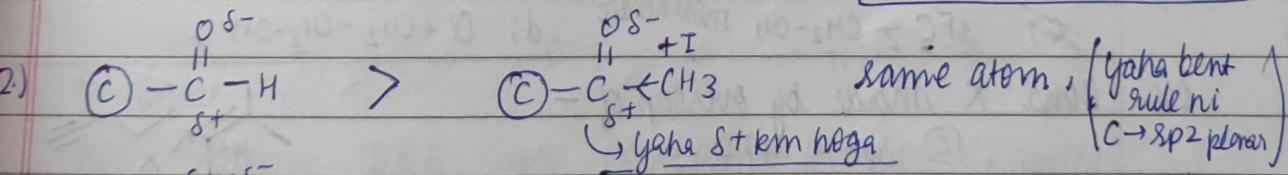
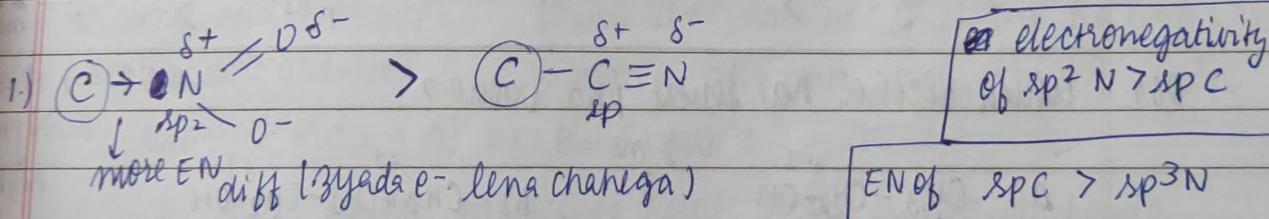
by Bent rule \rightarrow agr % s character \rightarrow B end angle T
 E.N.T

$-\text{O}-\text{R}$ me repulsion zyada h then $-\text{O}-\text{H}$
 (ether) repulsion T \Rightarrow BAT \Rightarrow E.N.T (alcohol)

as EN of O in $-\text{OR} > -\text{OH}$, ton -DR ka O Jldise e- nhidge.
 Hence $+\text{M}$ power $-\text{OH} > -\text{OR}$

Q. Arrange decreasing order of $-\text{M}$ groups?

\rightarrow first assign partial charges to grp acc to polarity of π bond.
 Jaha S+ zyada \rightarrow vo better $-\text{M}$ group.



$[\text{C}-\text{N} > \text{C}-\text{O}$ overlapping] \rightarrow total resonance in (6) $>$ (6)
 Hence $a > b$

(C) \rightarrow hypothetical group (Jha C-group lega)

Jitna zyada en diff b/w (C) & the first atom of group
 \hookrightarrow more is -M if S on first atom.