VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

Introduction to organic chemistry

IOC

Topics included:

(1) Nomenclature

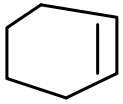
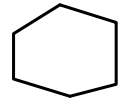
(2) GOC-I (Electronic displacement effects)

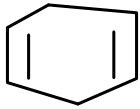
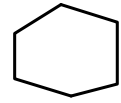
(3) GOC- II (Stability of intermediates)

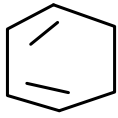
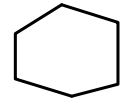
(3) GOC-III (Acidity & Basicity)

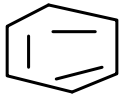
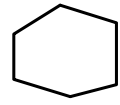
(4) Isomerism

(3) Heat of hydrogenation (HOH) → It is the amount of heat released in hydrogenation of 1 mole of alkene.

 + H_2 ⟶  ; $\Delta H = -29$ Kcal.

 + $2H_2$ ⟶  ; $\Delta H = -58$ kcal.

 + $2H_2$ ⟶  ; $\Delta H = -54$ kcal.
R.E. = 4 K cal.

 + $3H_2$ ⟶  ; $\Delta H = -51$ kcal.
R.E. = 36 kcal.

HOH ⇒ b > c > d > a

HOH (per mol π bond) ⇒ a = b > c > d

Rules to predict HOH ⟶

(i) HOH $\propto$ No. of π − bonds

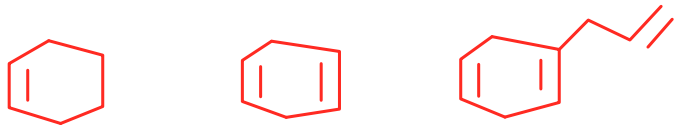
(ii) If π bonds are same, HOH $\propto \frac{1}{\text{Stab. of alkene}}$

Q. order of HOH ?

(a)

b > a

(b)



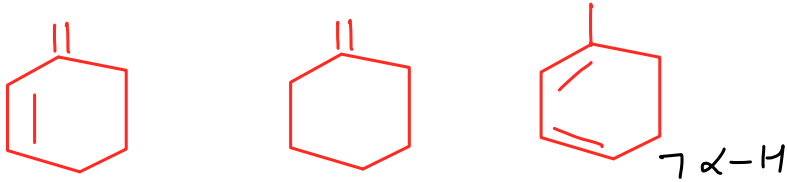
c > b > a

(c)

stab. ⇒ d > c > a > b

HOH ⇒ b > a > c > d

(d)



4 α-H

a > c > b

7 α-H

(e)

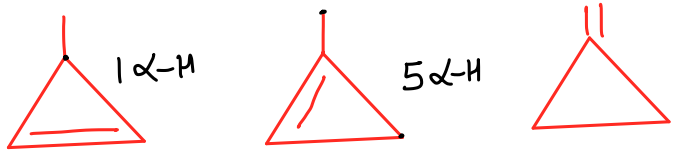
(A.A.)

(N A.)

stab. ⇒ b > a

HOH ⇒ a > b

(f)



1 α-H

5 α-H

* Double bond in 3-membered ring creates Unstability due to strain.

stab. ⇒ c > b > a

HOH ⇒ a > b > c

(g) $\pi-\pi$ repulsion

$C=C=C-C-C$ (a) Cumulated

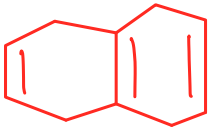
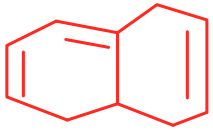
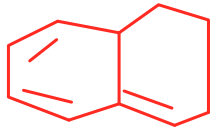
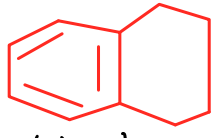
$C=C-C=C-C$ (c) Conjugated

$C=C-C-C=C$ (b) Isolated

Stab $\Rightarrow$ c > b > a

HOH $\Rightarrow$ a > b > c

(h)

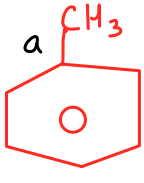
(Ar.)

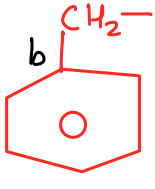
stab. $\Rightarrow$ d > c > b > a

HOH $\Rightarrow$ a > b > c > d

(4) To Predict Bond order / Bond length / B.E. $\rightarrow$

(i)



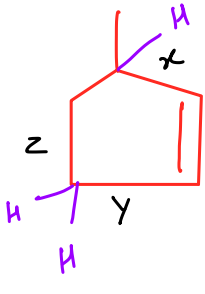


B.O. $\Rightarrow$ a > b

B.E. $\Rightarrow$ a > b

B.L. $\Rightarrow$ b > a

(ii)



B.O. $\Rightarrow$ Y > X > Z

B.E. $\Rightarrow$ Y > X > Z

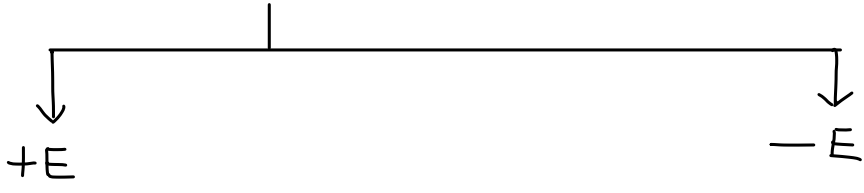
B.L. $\Rightarrow$ Z > X > Y

Electromeric effect ⟶ It is temporary effect but more powerful than inductive effect.

* It involves transfer of πe^-s by the demand of attacking reagent towards more E.N species.

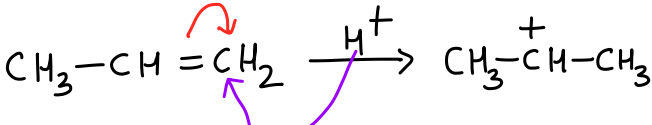
* It is shown by comp. having $\backslash C=C/$, $\backslash C=O$, $-C\equiv N$ etc.

Two types ⟶

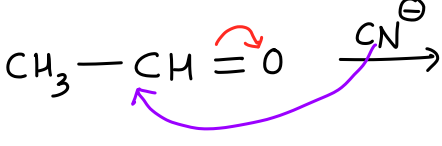


Attack of attacking reagent to the atom where πe^-s are transferred

Attack of attacking reagent to the atom from where πe^-s are transferred.



(+E)



(−E)

Bond cleavage / Bond breaking

Homolysis

Conditions → (i) $\Delta E.N. \simeq 0$

(ii) Non Polar medium or solvent
(CCl_4, CS_2 etc.)

(iii) Vapour Phase should be Present

(iv) Presence of HELPR

H = Heat $\geq 50^\circ C$

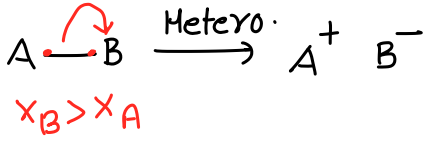
E = Electricity

L = Light / U.V. / $h\nu$

P = Peroxide

R = Radical

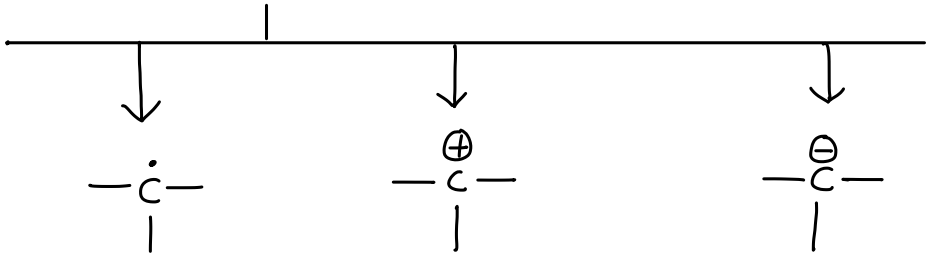
Heterolysis



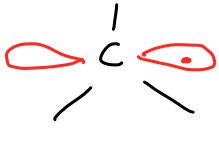
(i) $\Delta E.N.$ = large

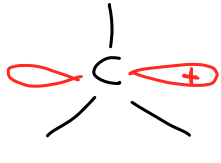
(ii) Polar solvent
(H_2O, alcohol etc.)

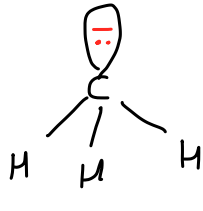
Types of Rxn Intermediates ⟶



Name —	Carbfree radical	Carbo cation or carbonium ion	Carbanion or Carbanium ion
Valence e^- —	7	6	8
Nature —	Paramagnetic	Dia.	Dia.
Lewis acid or Lewis base —	X	L.A.	L.B.
Electrophile or Nucleophile —	$E^{\oplus}$	$E^{\oplus}$	$Nu^{\ominus}$
Hyb. —	sp^2	sp^2	sp^3
Shape —	Trigonal planar	Trigonal planar	Pyramidal

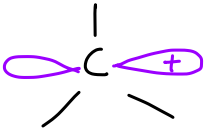






Applications of electronic displacement effects →

Stability of carbocations →



⇒ octet Incomplete

So It gets stable by completing its octet.

Carbocations stabilized by : +M > Reso > H.C. > +I

Ar. > N.A.

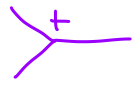
Carbocations destabilized by : −M > −I

Stab. of Intermediates ∝ Rate of breaking of bonds

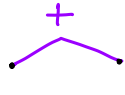
$$\propto \frac{1}{\text{Bond energy of bond responsible to form that intermediate}}$$

Q. Find order of stab. of following —

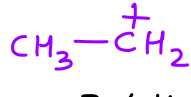
(1)



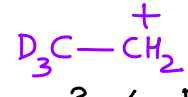
9 α-H



6 α-H

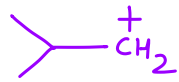


3 α-H



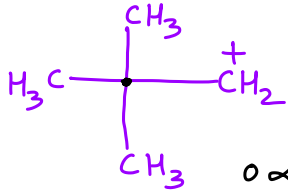
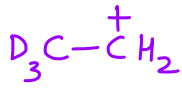
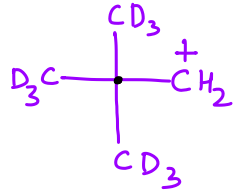
3 α − D

a > b > c > d

(2) $H_3C-\overset{+}{C}H_2$ $H_3C-CH_2-\overset{+}{C}H_2$ 

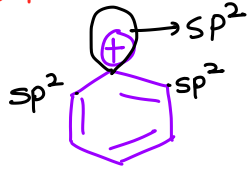
3α-H 2α-H 1α-H 6α-H

d > a > b > c

(3) $H_3C-\overset{+}{C}H_2$   

3α-H 0α-H 3α-D 0α-H

a > c > d > b → less +I; d → more +I

(4) $H_3C-\overset{+}{C}H_2$ $\overset{sp^2}{CH_2}=\overset{+}{C}H$  $HC\equiv\overset{\oplus}{C}$

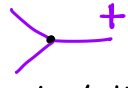
3α-H −I sp

a > b > c > d

(5) $Ph-\overset{+}{C}H_2$ $CH_2=CH-\overset{+}{C}H_2$ $CH_2=\overset{+}{C}H$ $Ph^{\oplus}$

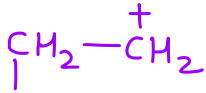
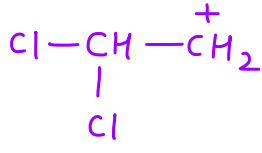
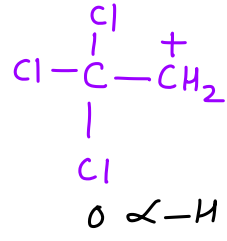
5 R.S. 2 R.S.

a > b > c > d

(6) $CH_3-\overset{+}{C}H_2$ $CH_3-CH_2-\overset{+}{C}H_2$ 

3α-H 2α-H 1α-H 0α-H

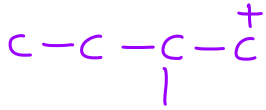
a > b > c > d

(7) $H_3C-\overset{+}{C}H_2$   

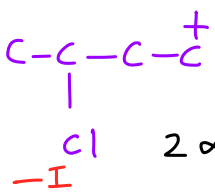
3α-H 2α-H 1α-H 0α-H

a > b > c > d

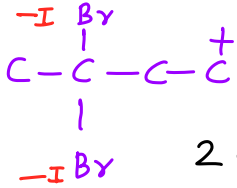
(8)



1 α-H



2 α-H



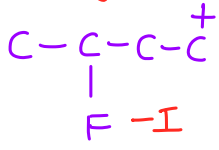
2 α-H

−I, +I ⇒ D > N > P

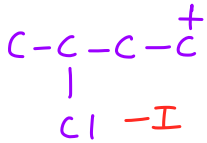
D → distance, N → no., P → Power

b > c > a → More −I

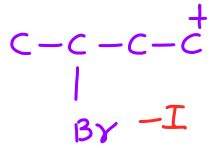
(9)



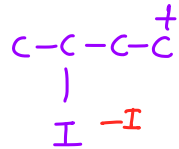
2 α-H



2 α-H



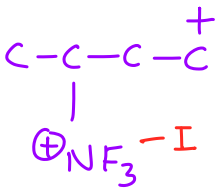
2 α-H



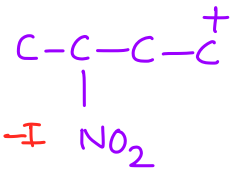
2 α-H

d > c > b > a

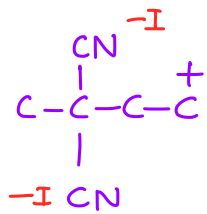
(10)



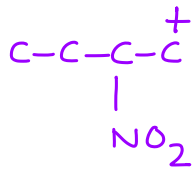
2 α-H



2 α-H



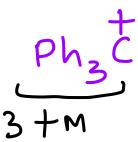
2 α-H



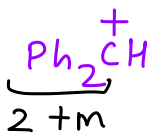
1 α-H

b > a > c > d

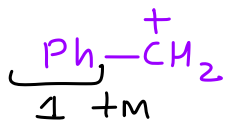
(11)



3 +M



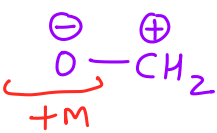
2 +M



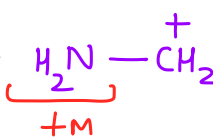
1 +M

a > b > c > d

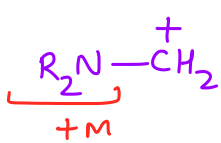
(12)



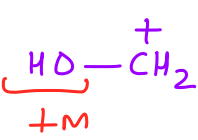
+M



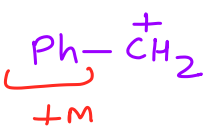
+M



+M

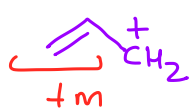


+M

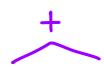


+M

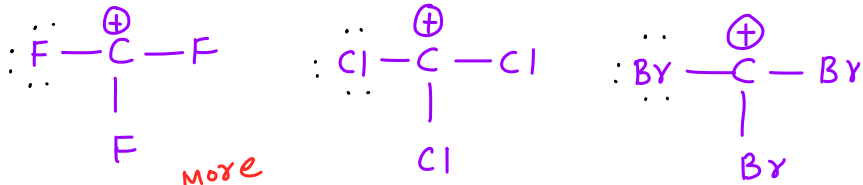
+M



+M

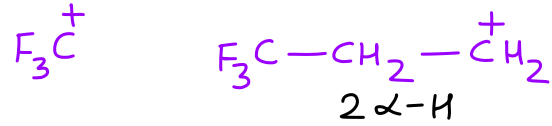


6 α-H

(13) 

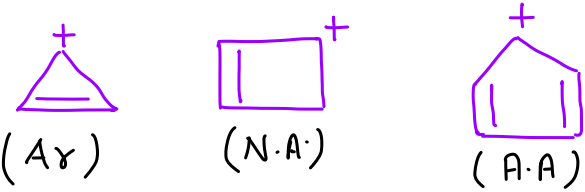
more +M ← a > b > c

(stab. increases by completing octet so compare by +M)

(14) 

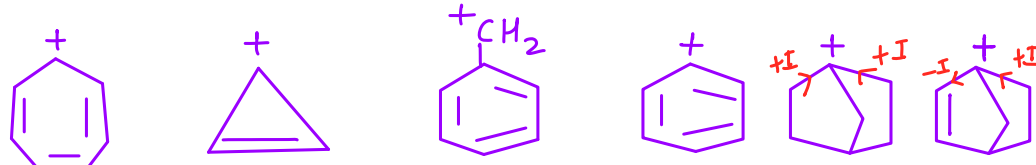
2 α-H

a > b > c

(15) 

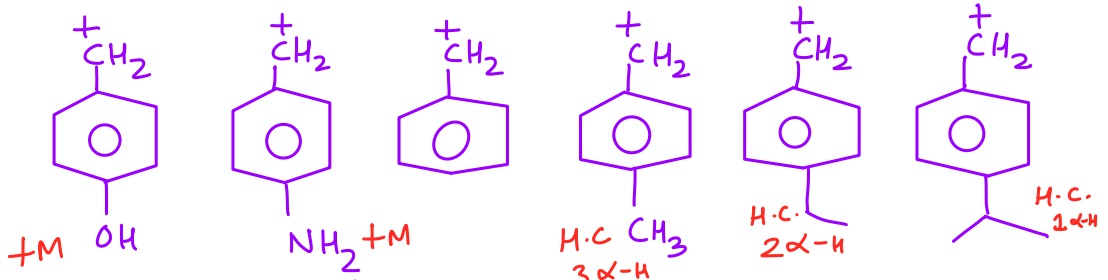
(Ar) (N.A.) (A.A)

a > b > c

(16) 

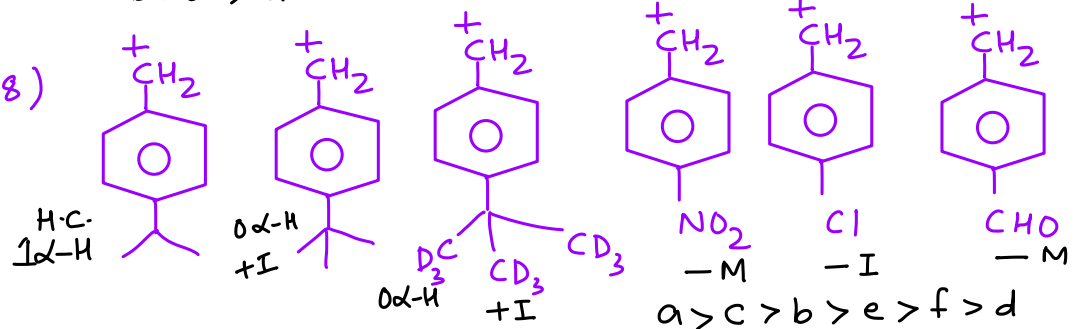
(7 eq R.S.)(Ar.) (3 eq R.S.)(Ar.)

a > b > c > d > e > f → -I

(17) 

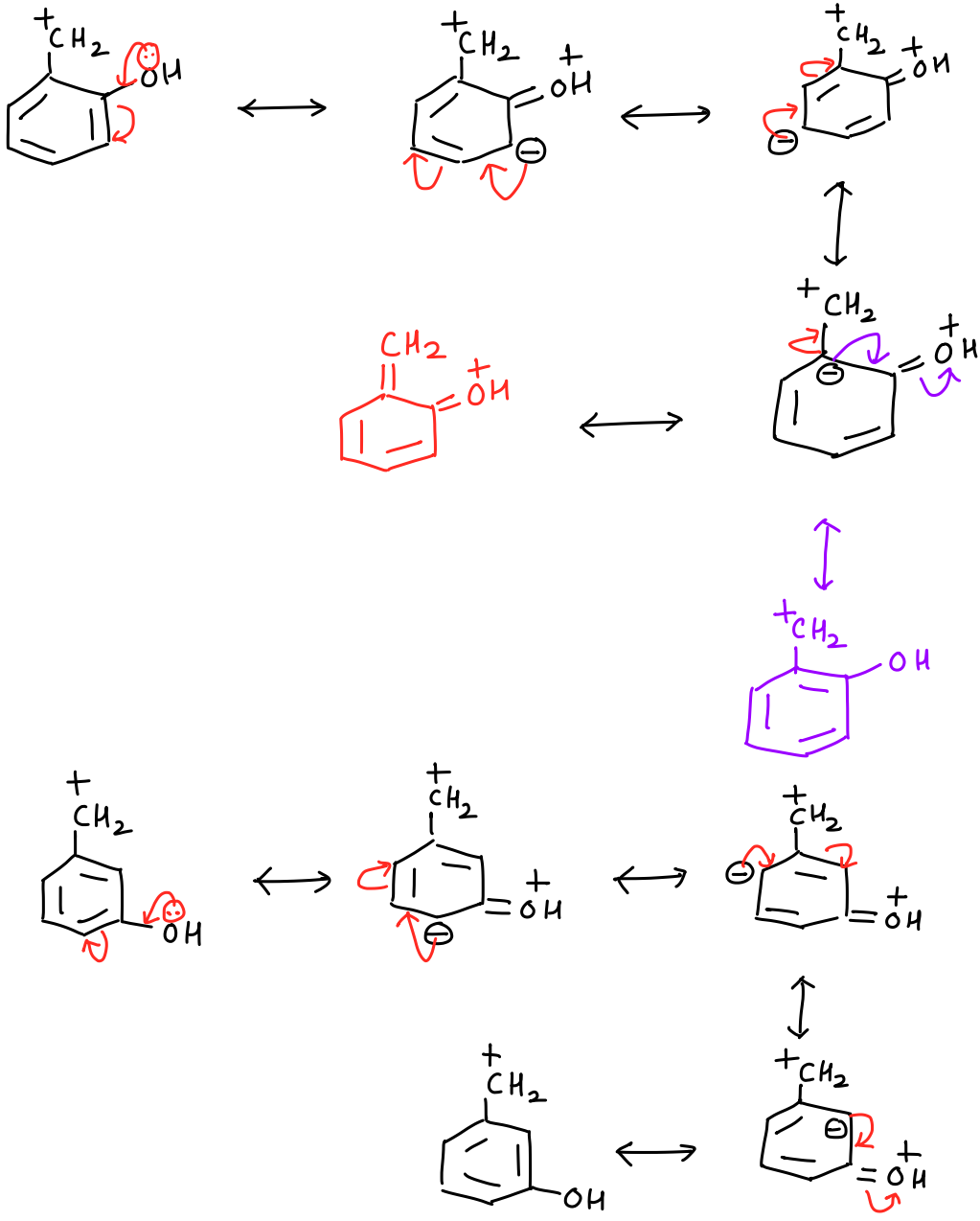
+M OH NH_2 +M H.C CH_3 3 α-H H.C. 2 α-H H.C. 1 α-H

b > a > d > e > f > c

(18) 

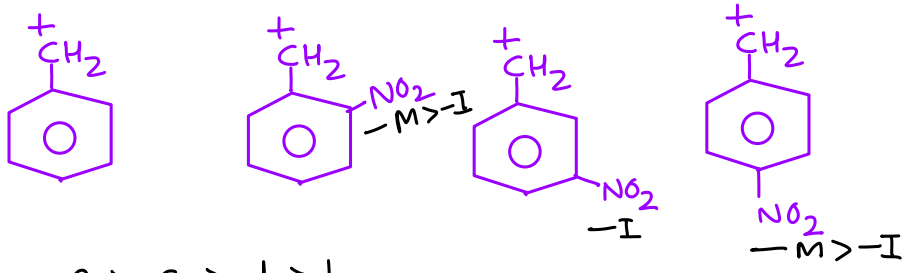
H.C. 1 α-H 0 α-H +I 0 α-H +I NO_2 −M Cl −I CHO −M

a > c > b > e > f > d



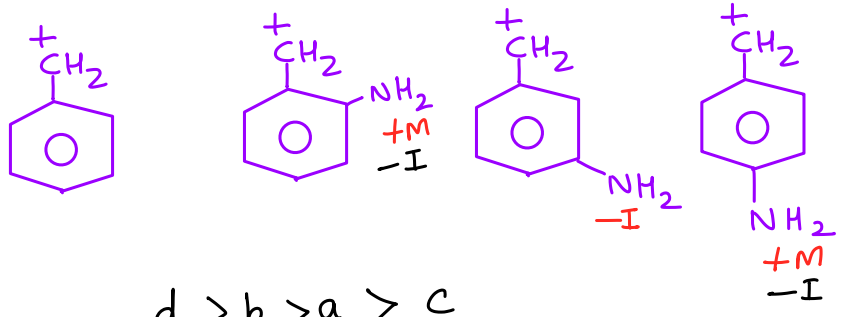
Note → If M-groups and H.C. groups are present at o/p position to $-\overset{\oplus}{C}-$ / $-\overset{\ominus}{C}-$ / $-\dot{C}-$ then they affect their stability but If those groups are at meta position then they will not affect stab. of intermediates

(19)



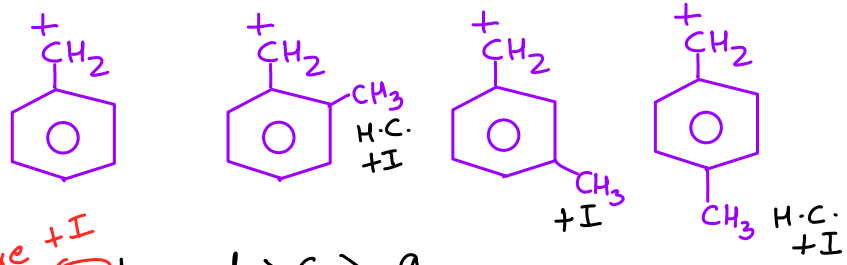
$a > c > d > b$ → more $-I$

(20)



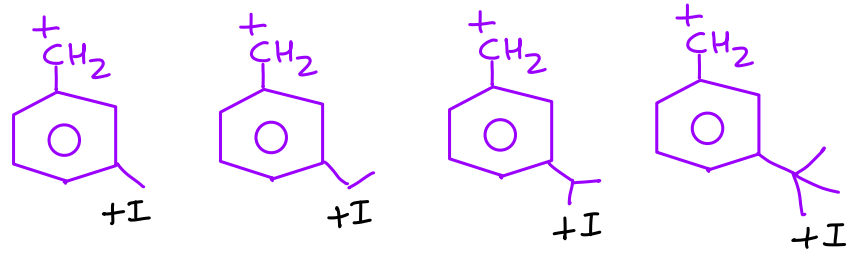
$d > b > a > c$

(21)



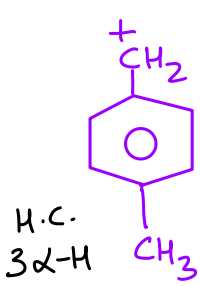
more $+I$ ← $b > d > c > a$

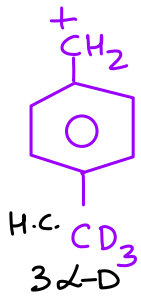
(22)

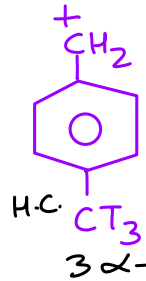


more $+I$ ← $d > c > b > a$ → less $+I$

(23)

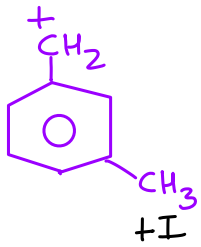


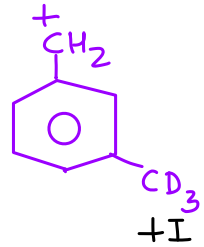


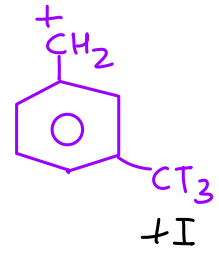


a > b > C

(24)







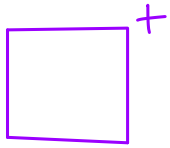
c > b > a

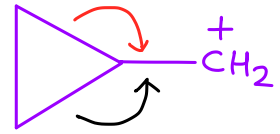
more +I

less +I

Imp.

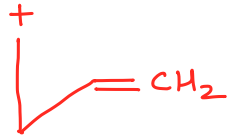
(25)

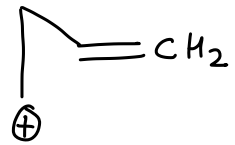




Dancing Resonance

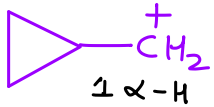
(b > a)





**

(26)



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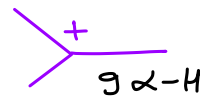
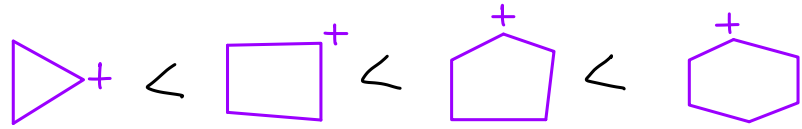
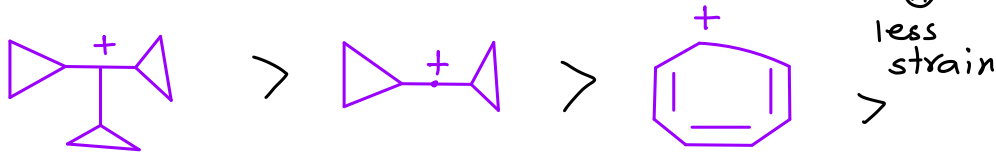
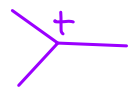


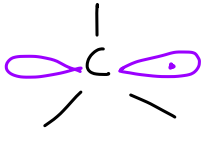
(27)  < < <

six memb. ring
⇓
less strain

(28)  > > >

> $Ph_3-\overset{+}{C}$ > $Ph_2\overset{+}{C}H$ >  > $Ph-\overset{+}{C}H_2 \geqq CH_2=CH-\overset{+}{C}H_2$

stability of carbfree radicals ⟶



⇒ octet Incomplete

So It gets stable by completing its octet.

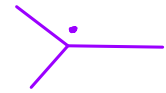
Carbfree radical stabilized by : +M > Reso > H.C. > +I

Ar. > N.A.

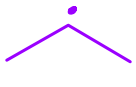
Carbfree radical destabilized by : −M > −I

Q. write the order of stability ?

(1)

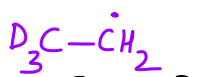


9 α-H



6 α-H

2 α-H

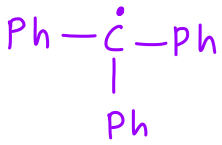


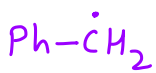
3 α-D

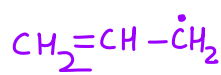
3 α-H

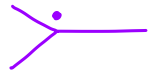
a > b > f > e > c > d

(2)









a > b > c > d > e

(3)

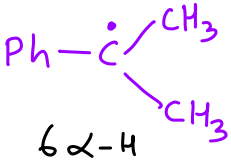
3 α-H

6 α-H

6 α-H

c > b > a > d

(4)

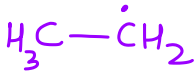


6 α-H

3 α-H

a > b > c

(5)



3 α-H

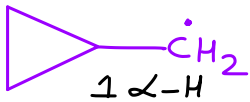
+M

+M

c > b > a

(6)

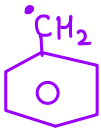
4 α-H

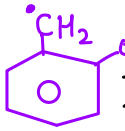


1 α-H

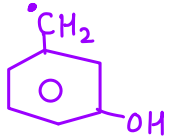
a > b

(7)

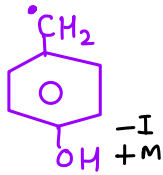




+M
−I



−I



−I
+M

d > b > a > c

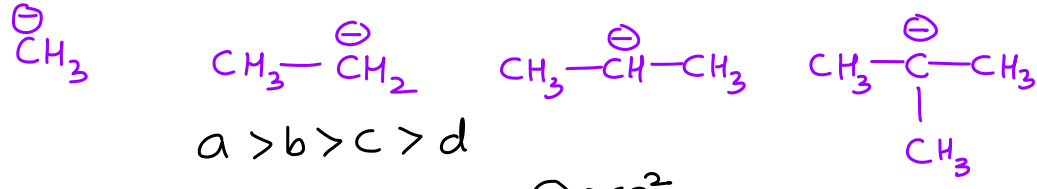
stab. of carbanions →

⇒ octet complete, having lp so stablize by donating its e^-.

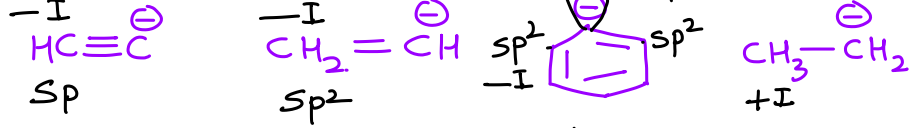
Stabilised by ⇒ −M > Reso > −I → Ar. > NA

destabilised by ⇒ +M > H.C. > +I → If applicable

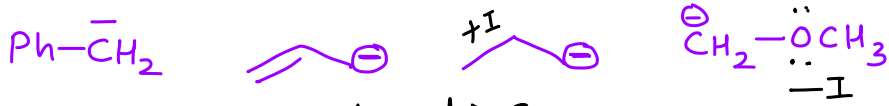
Q. write the order of stab. ?

(1) 

a > b > c > d

(2) 

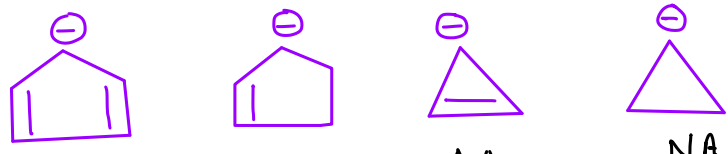
a > c > b > d

(3) 

a > b > d > c

(4)

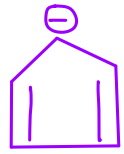
a > b > c > d

(5) 

Ar. NA AA NA

a > b > d > c

(6)



5 eq. Rs.

$CH \equiv C^{\ominus}$

No conj.

$a > b$

(7)

$CH_2(\ominus)-CH=O$ (−M)

$CH_2(\ominus)-NO_2$ (−M)

$CH_2(\ominus)-C(=O)-CH_3$ (−M)

$CH_2(\ominus)-C(=O)-OCH_3$ (−M)

$b > a > c > d$

(8)

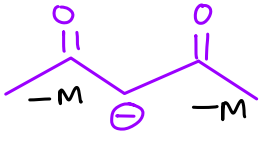
$CH_2(\ominus)-C(=O)-CH_3$ (−M)

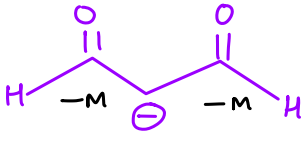
$CH_2(\ominus)-C(=O)-OCH_3$ (−M)

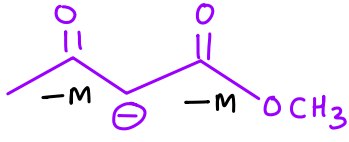
$CH_2(\ominus)-C(=O)-CH_2-OCH_3$ (−M, −I)

$c > a > b$

(9)





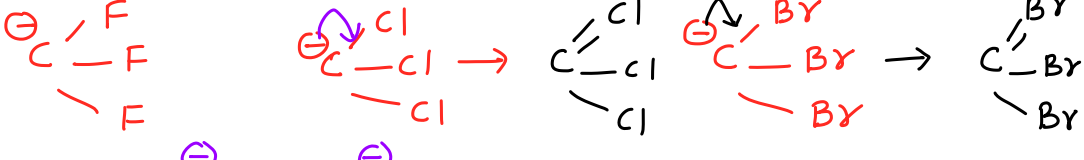


$b > a > c > d$

$CH_2(\ominus)-C(-M)(=O)-CH_3$

(10)

$CF_3^{\ominus}$ $CCl_3^{\ominus}$ $CBr_3^{\ominus}$



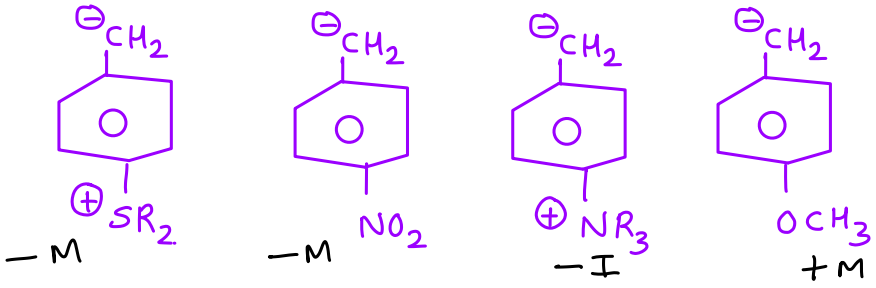
$a < b < c$ (−ve on bigger atom)

(11)

$Ph-CH_2^{\ominus}$ $CCl_3^{\ominus}$

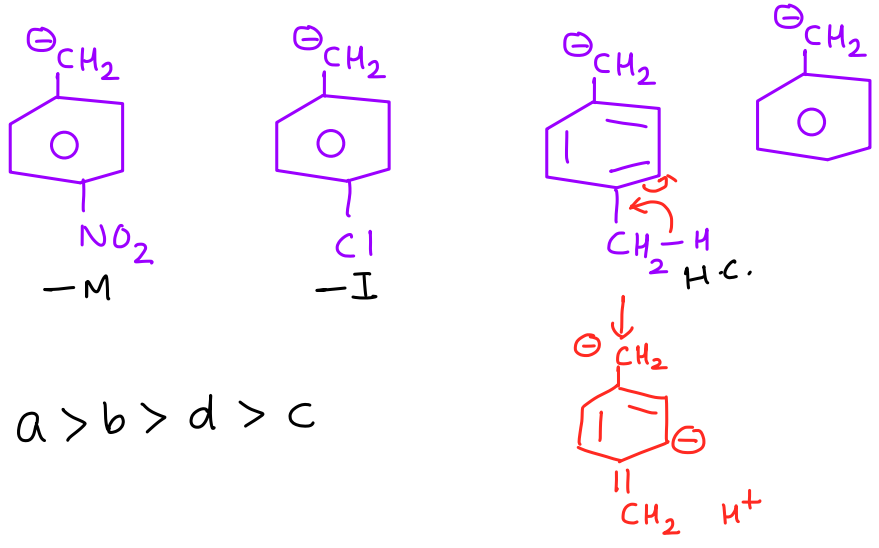
$b > a$

(12)



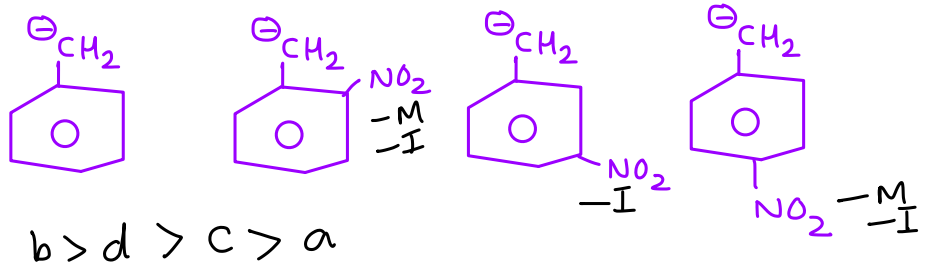
a > b > c > d

(13)



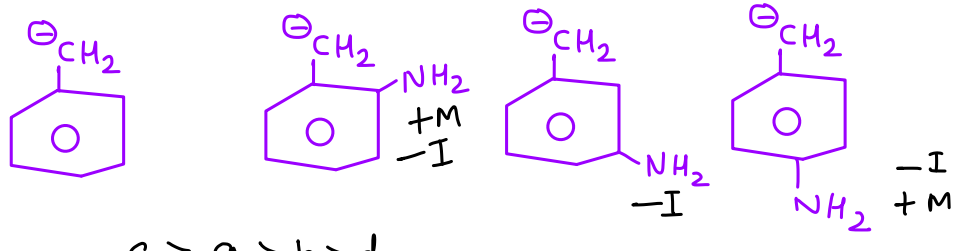
a > b > d > c

(14)



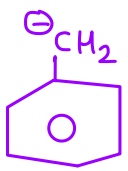
b > d > c > a

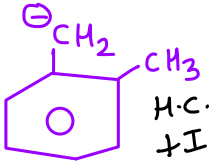
(15)

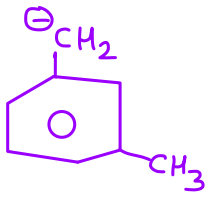


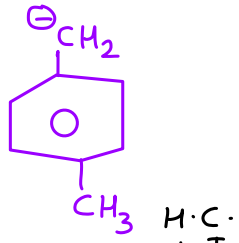
c > a > b > d

(16)



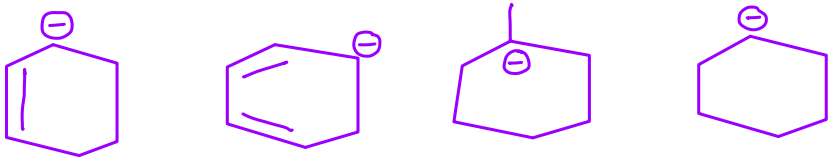






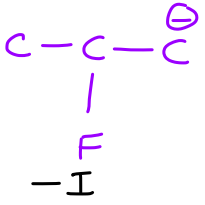
a > c > d > b

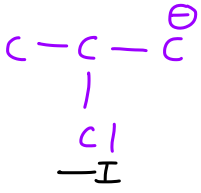
(17)

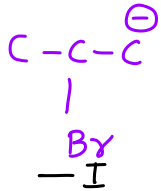


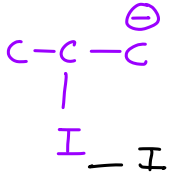
b > a > d > c

(18)



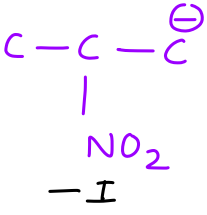


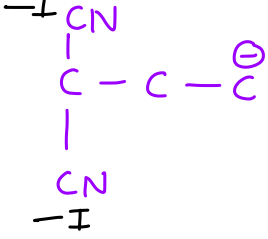


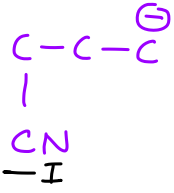


a > b > c > d

(19)

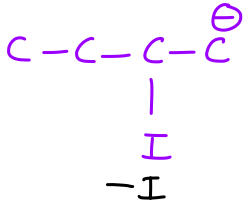


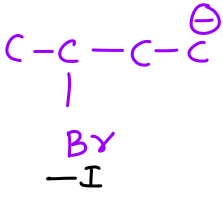


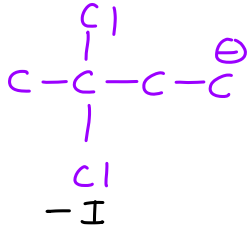


a > b > c

(20)

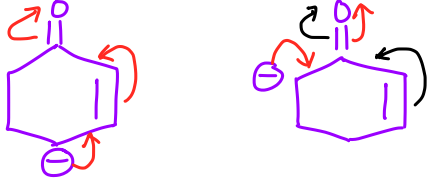






a > c > b

(21)

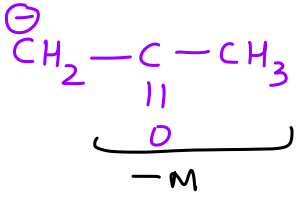


a > b

↓

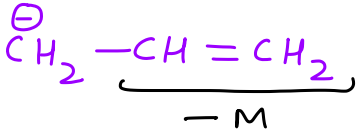
extended conjugation

(22)



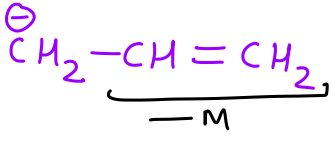
−M

a > b



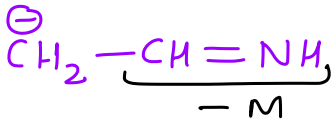
−M

(23)



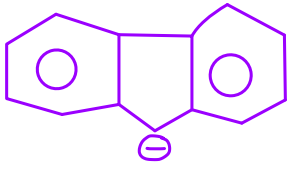
−M

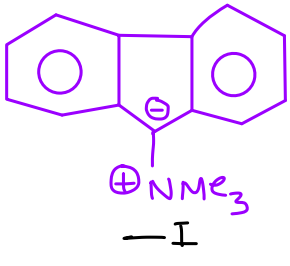
b > a



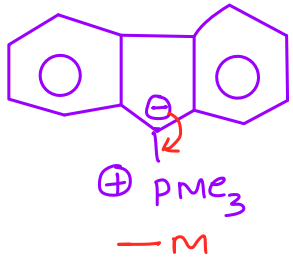
−M

(24)





−I



−M

c > b > a

Homework

DTS-1-11
Q.34-39,68,115-123
JEE MAIN ARCHIVE: Q.16,26,35,72
JEE ADVANCED ARCHIVE: Q. 6,20,32,63