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

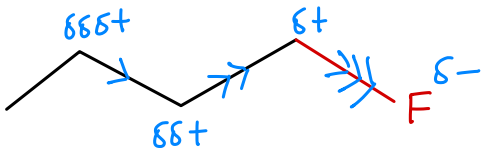
General organic chemistry

Electronic displacement effects → Effect arises due to the displacement of electrons (σ/π e⁻s) is known as electronic displacement effect.

Types →

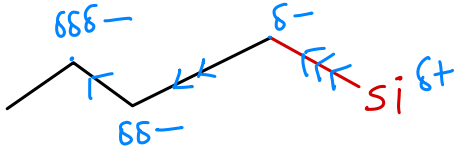
- Inductive effect / Transmission effect / I effect / T effect
- Resonance / mesomeric effect (R/M effect)
- Hyperconjugation effect (H-effect)
- Electromeric effect (E-effect)

Inductive effect → If σ bonds are formed b/w two diff. E.N. atom then a dipole will be formed. Due to this dipole remaining σ electrons in the molecule will also be polarised. This induction of polarity in remaining σ electrons towards the dipole is known as Inductive effect.



$(E.N.)_F > (E.N.)_C$

$\delta- = (\delta+) + (\delta\delta+) + (\delta\delta\delta+)$



$(E.N.)_{Si} < (E.N.)_C$

$\delta+ = (\delta-) + (\delta\delta-) + (\delta\delta\delta-)$

characteristics of inductive effect →

(1) It is permanent effect.

(2) It is weak effect since σ electrons are strongly held.

(3) It depends on distance and considered to be negligible beyond three carbon atoms.

$$\text{I-effect} \propto \frac{1}{\text{distance}}$$

(4) Electrons never leave their original atomic orbitals, they are only slightly displaced.

(5) This effect is additive in nature because on Increasing no. of groups, I-effect will also increase.

Types of I- groups →

Two types → +I (Electron donating / e^- releasing group / EDG / ERG)

→ −I (Electron withdrawing group)

Identification of +I/−I groups →

	+I	−I
Charge	−ve charge	+ve charge
Neutral	(E.N) ≤ sp^3−C	(E.N) > sp^3−C

$sp^3-C < sp^2-C < N_{sp^3} < C_{sp} < N_{sp^2} < N_{sp}$

Q. Identify +I, −I groups.

(1) $-OH$ — −I

(2) $-NH_2$ — −I

(3) $-OR$ — −I

(4) $-\overset{+}{N}H_3$ — −I

(5) $-\overset{+}{N}F_3$ — −I

(6) $-\overset{+}{N}R_3$ — −I

(7) $-\overset{+}{C}H_2$ — −I

(8) $-\overset{\ominus}{C}H_2$ — +I

(11) $-\underset{\underset{O}{\|}}{C}-R$ — −I

(12) $-\underset{\underset{O}{\|}}{C}-OH$ — −I

(13) $-\underset{\underset{O}{\|}}{C}-Cl$ — −I

(14) $-N\overset{O}{\underset{\rightarrow O}{\overset{\|}{}}}$ — −I

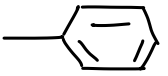
(15) $-C\equiv N$ — −I

(16) $-X$ — −I

(17) $-CH=CH_2$ — −I

(9) $-O^{\ominus}$ $+I$

(10) $-\overset{sp^2}{C}(=O)-H$ $-I$

(18)  $-I$

(19) $-CH_2-CH_3$ $+I$

(20) $-CH_3$ $+I$

Strength of +I groups →

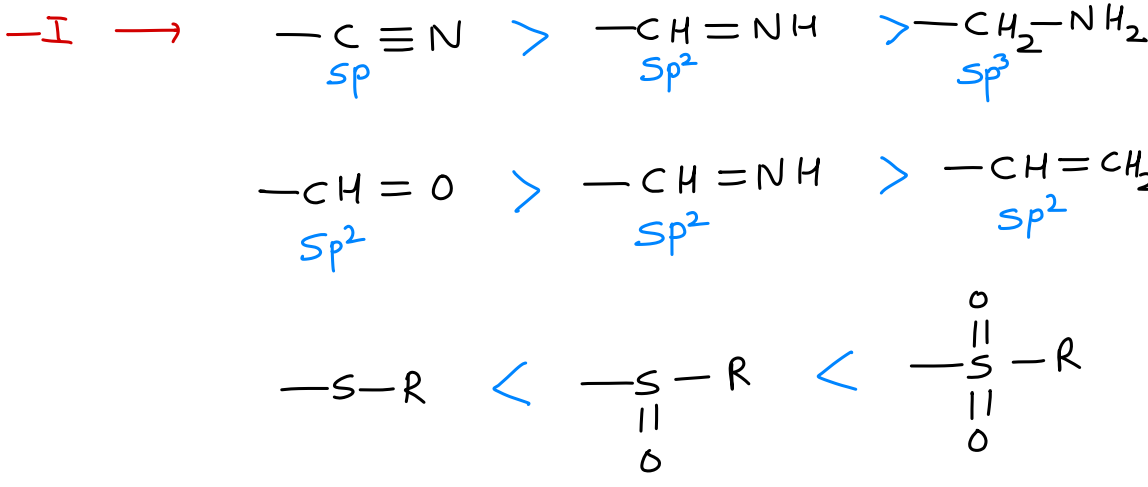
$$-\overset{\ominus}{C}H_2 > -\overset{\ominus}{N}H > -O^{\ominus} > -C(=O)-O^{-} > -S(=O)_2-O^{-} > -C(Me)_3 > -CH(Me)_2 > -CH_2-CH_3 > -CT_3 > -CD_3 > -CH_3$$

strength of −I groups → −I ∝ E.N.

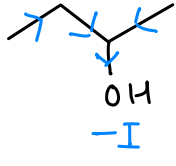
$$-\overset{+}{N}F_3 > -\overset{+}{O}R_2 > -\overset{+}{N}R_3 > -\overset{+}{S}R_2 > -\overset{+}{N}H_3 > -\overset{+}{N}H_2R > -\overset{+}{N}HR_2 > -NO_2 > -SO_3H > -CN > -CHO > -C(=O)-R > -C(=O)-OH > -F > -Cl > -Br > -I > -OR > -OH > -C\equiv CH > -NH_2 > -C_6H_5 > -CH=CH_2$$

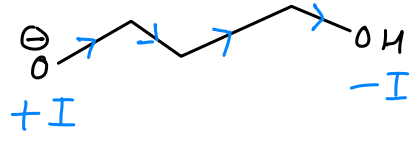
($-C\equiv CH$: sp; $-C_6H_5$: sp^2; $-CH=CH_2$: sp^2)

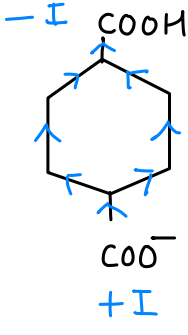
I effect of H = 0

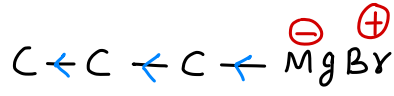


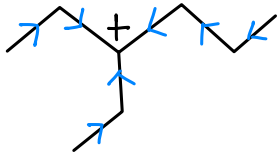
Q. Find direction of e^- flow in the following-

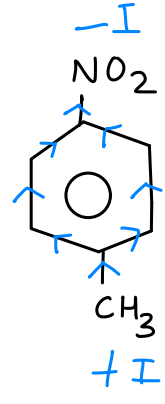






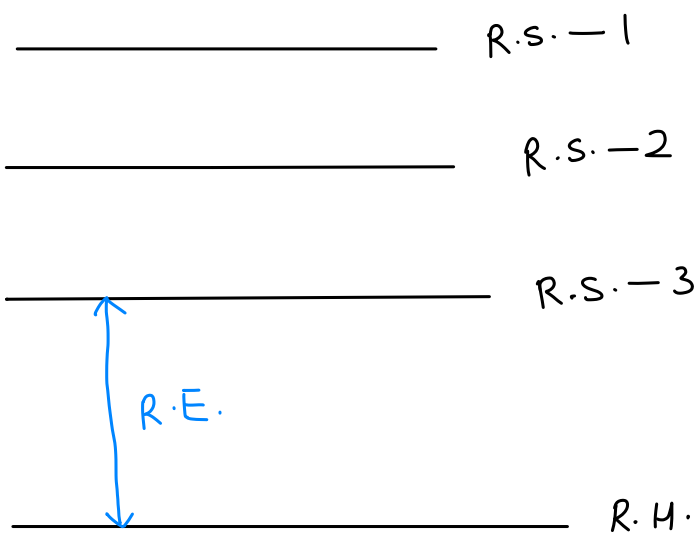






Resonance ⟶ when All the properties of a molecule cannot be explained by a single lewis structure then by contribution of two or more lewis structures, a hybrid structure will be formed which explains all the properties of molecule. This Phenomenon is called resonance. Different contributing structures are called resonating structures or canonical forms. Hybrid structure is called resonance hybrid.

* Resonance hybrid is real structure of molecule.
* In Resonance Net charge, Position of atom, Total no. of lp + bp, skeleton of molecule will not change. But Position/no. of multiple bonds may change.
* more stable R.S. will contribute more to R.H.
* Energy difference b/w more stable R.S. and R.H. is called resonance energy.



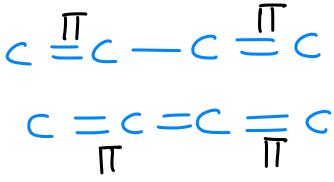
Stab. of a molecule $\propto$ Resonance energy

Conditions for resonance →

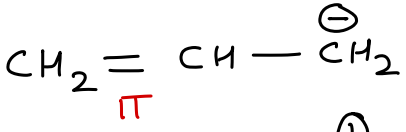
(1) Planarity → P/d orbitals must be coplanar.

(2) Conjugation → (Alternate System)

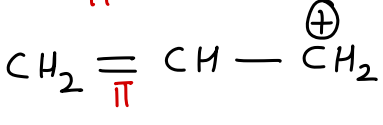
(i) $\pi - \pi$



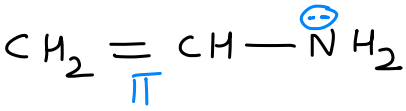
(ii) $\pi - \ominus$



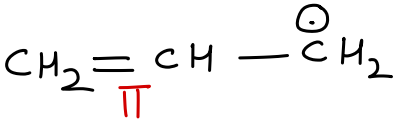
(iii) $\pi - \oplus$



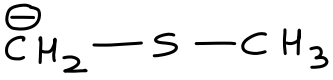
(iv) $\pi - lp$



(v) π – odd e⁻

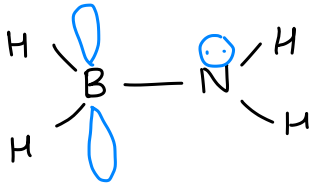


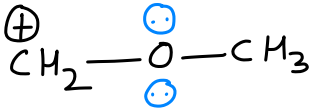
(vi) $\ominus$ – d orbital resonance



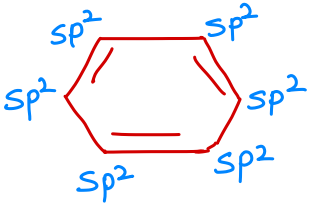
(vii) Back bonding → vacant orbital – lp

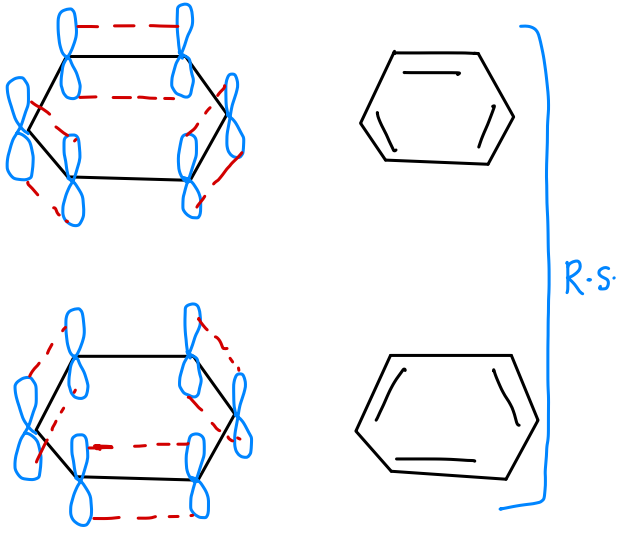
→ $\oplus$ – lp





Ex.





R·S.

R·H.

Rule to draw R.S. ⟶

flow of e⁻ from higher e⁻ density to lower e⁻ density.

$\ominus / lp \rightarrow \pi \longrightarrow \oplus$

If $\pi - \pi$ conjugation : less E.N. ⟶ More E.N.

Stab. of R.S. ⟶

(i) Stab. of R.S. $\propto$ No. of π - bonds

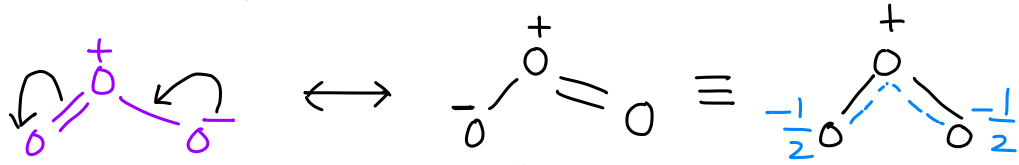
(ii) Neutral R.S. > Charged R.S.

(iii) -ve charge on more E.N. atom
+ve charge on less E.N. atom
will be more stable

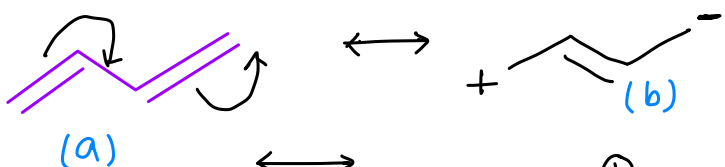
(iv) Charge separation ⟶ Like charges stay away, Unlike charges stay nearer.

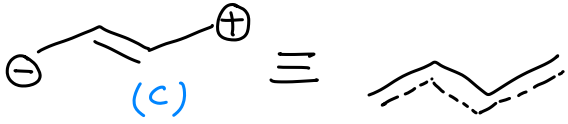
Q. Draw R.S. and R.H. of following molecules and compare stab. of R.S. :—

(i)



(ii)





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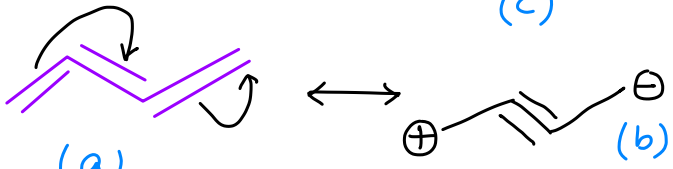

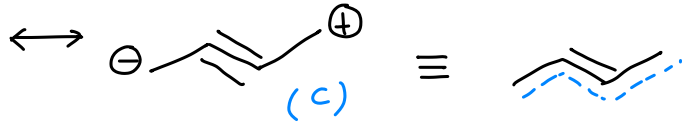

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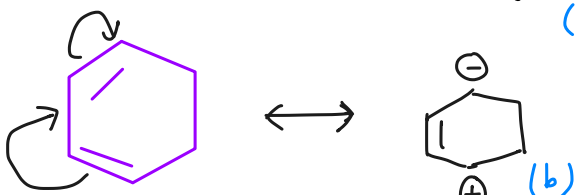
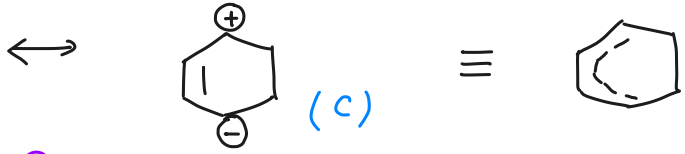
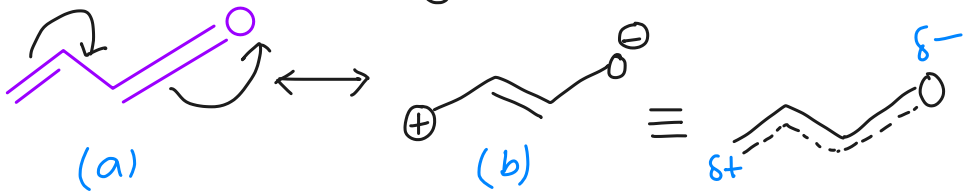
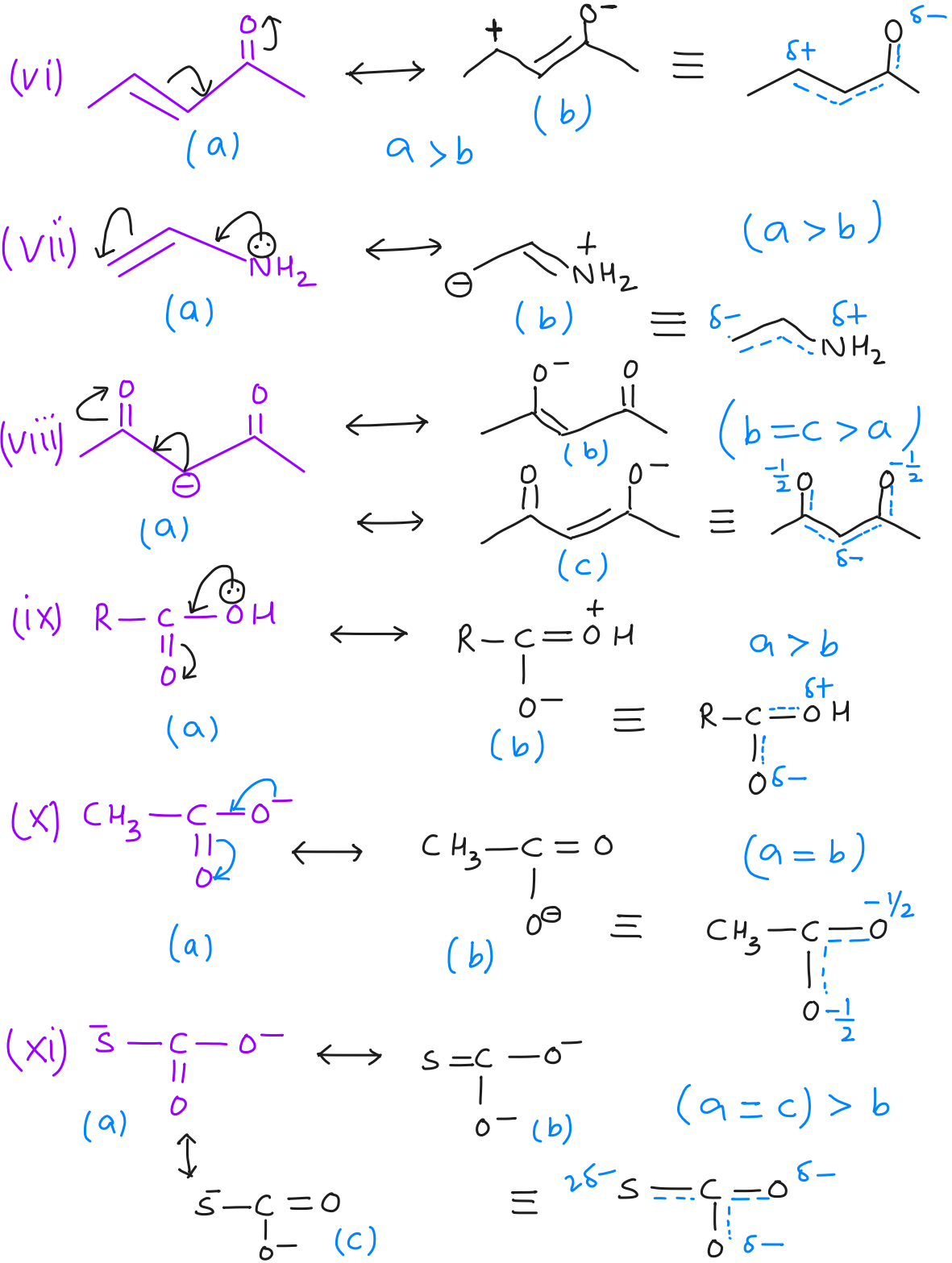


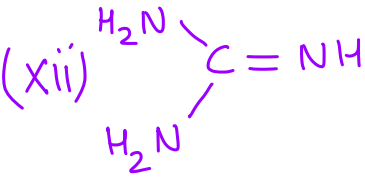


(v)

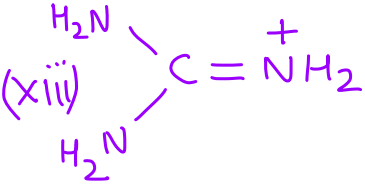


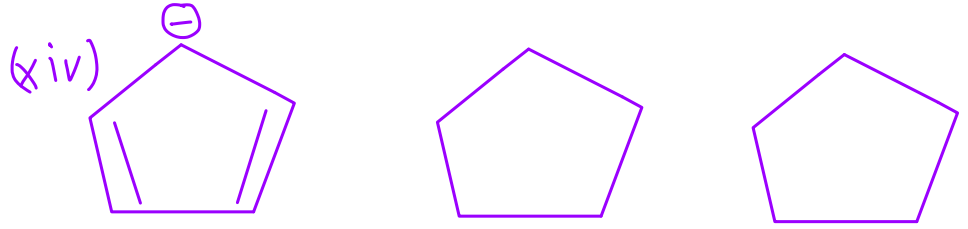
a > b

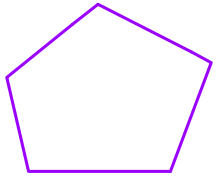

(vi)
(a)
(b)
a > b
δ+
δ−
(vii)
NH2
(a > b)
(viii)
(b = c > a)
(ix)
R − C − OH
a > b
(X)
CH3 − C − O−
(a = b)
(xi)
S − C − O−
(a = c) > b
2δ−

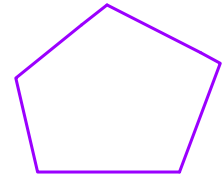
(xii) 

Guanidine

(xiii) 

(xiv) 





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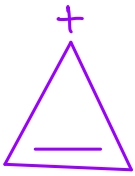
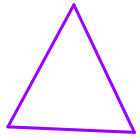
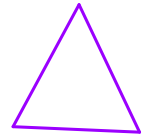
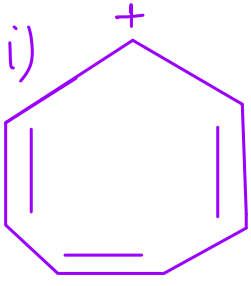
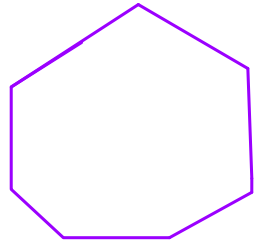


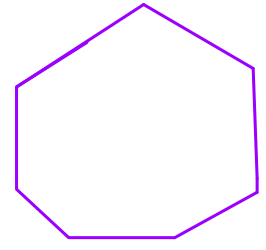


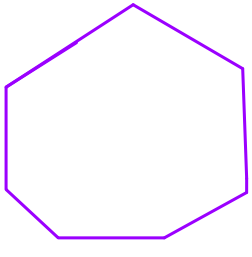


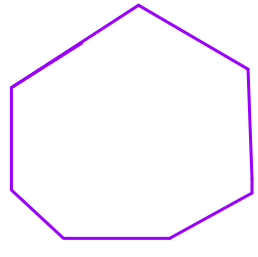
(xvi)

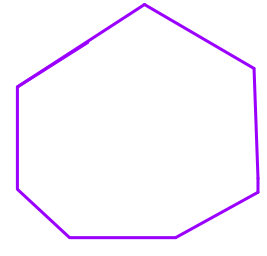


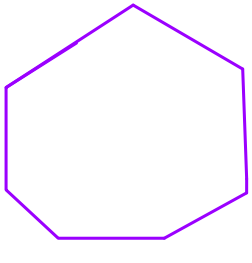


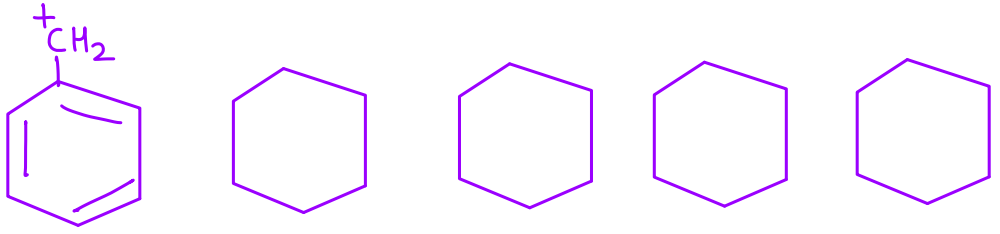








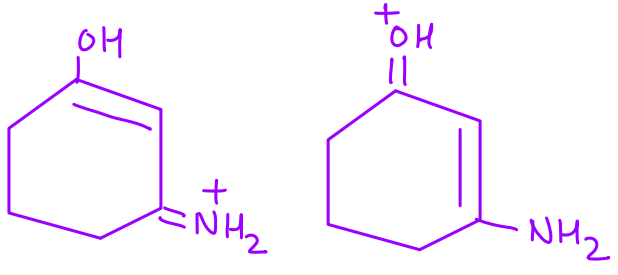


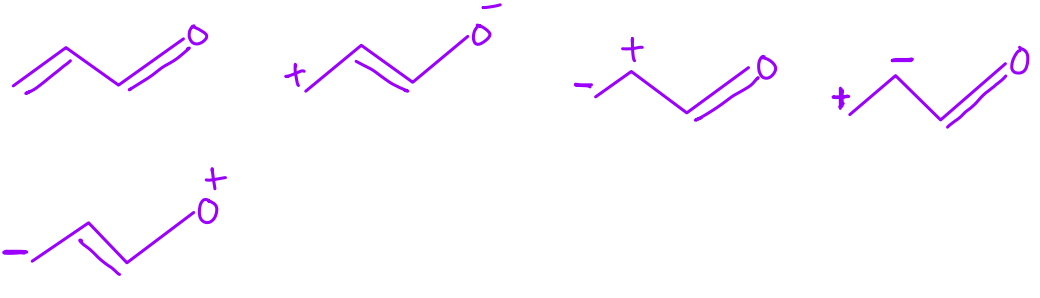
(xvii) 

Q. write the order of stab. of R.S. ?

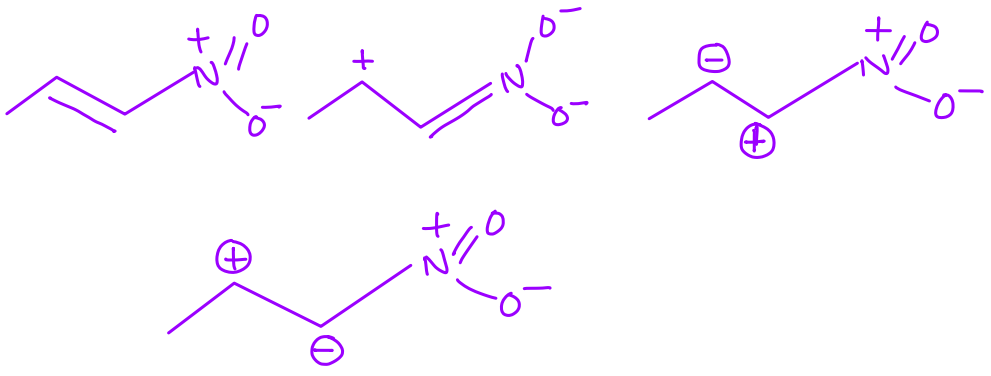
(1) 

(2) 

(3) 

(4) 

(5)



(6)

$CH_2=CH-CH=CH-OCH_3$

$\overset{\ominus}{C}H_2-CH=CH-CH=\overset{+}{O}-CH_3$

$CH_2=CH-\overset{\ominus}{C}H-\overset{\oplus}{C}H-O-CH_3$

$CH_2=CH-\overset{\oplus}{C}H-\overset{\ominus}{C}H-O-CH_3$

$CH_2=CH-\overset{\ominus}{C}H-CH=\overset{\oplus}{O}-CH_3$

(7)

$\overset{\ominus}{C}H_2-C\equiv N$ $\qquad$ $CH_2=C=\overset{\ominus}{N}$

(8)

$H_2N-CH=CH-BH_2$ $\qquad$ $H_2\overset{+}{N}=CH-CH=\overset{\ominus}{B}H_2$

(9) $CH_2=\overset{+}{N}=\overset{-}{N}$ $\quad$ $\overset{-}{C}H_2-\overset{+}{N}\equiv N$

$\overset{+}{C}H_2-N=\overset{-}{N}$ $\quad$ $\overset{-}{C}H_2-N=\overset{+}{N}$