



# CHEMISTRY

Target : JEE (Main)

GENERAL ORGANIC CHEMISTRY-I

#

# GENERAL ORGANIC CHEMISTRY-I

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### JEE (Main) Syllabus

Electronic displacement in a covalent bond; inductive effect, electromeric effect, resonance and hyperconjugation.

### JEE (Advanced) Syllabus

Inductive, Resonance mesomeric and Hyperconjugation Effect, Applications of Electronic Effects, Aromaticity, Reaction Intermediates.

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# General Organic Chemistry (GOC)-I

## Electronic effects :

### Electron displacement in organic compounds :

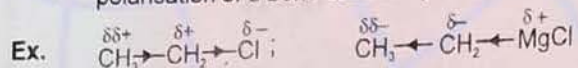
The electron displacement in an organic molecule may take place under the influence of an atom or a substituent group or in the presence of an appropriate attacking reagent.

Types of electronic displacement

1. Inductive effect
2. Resonance effect
3. Mesomeric effect
4. Hyperconjugation
5. Electromeric effect (temporary effect)

### 1. Inductive effect :

When a covalent bond is formed between the two atoms of different electronegativity then sigma bond pair of electrons are shifted towards more electronegative atom as a result dipole is created between two atoms. Due to this dipole, sigma bonded electrons in the carbon chain becomes polarised. Such polarisation of  $\sigma$  bond caused by the polarisation of adjacent  $\sigma$  bond is referred to as the **inductive effect**.



Note : (i) It is a permanent effect

(iii) It is operated through  $\sigma$  bond not through  $\pi$ -bond

(v) C-H bond is the reference of inductive effect i.e. polarity of C-H bond is considered to be negligible.

(ii) It is distance dependent

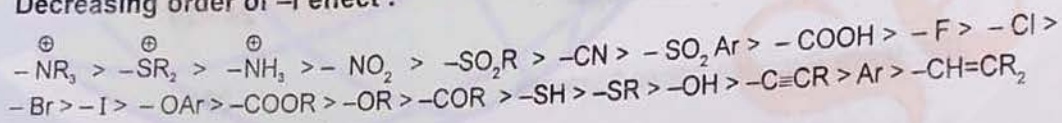
(iv) It is negligible after third carbon atom

Inductive effects are of two types :

#### (i) -I effect :

The atom or group which withdraws electron clouds is known as -I group and effect is called -I effect.

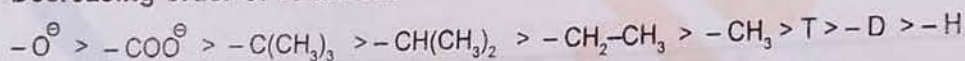
Decreasing order of -I effect :



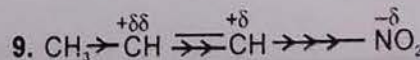
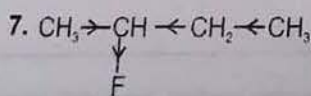
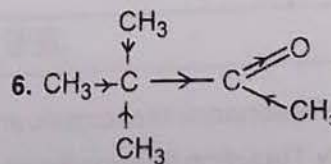
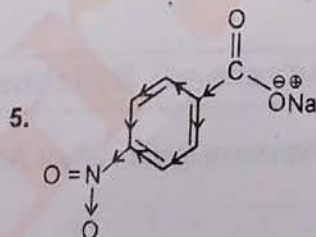
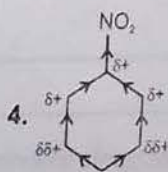
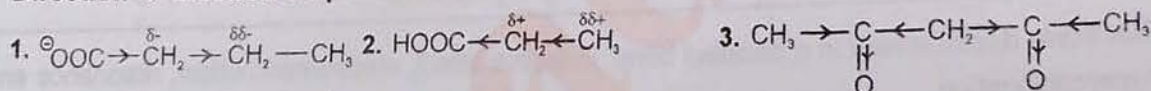
#### (ii) +I effect :

The group which releases or donates electron clouds is known as +I group & effect is called +I effect.

Decreasing order of +I effect :



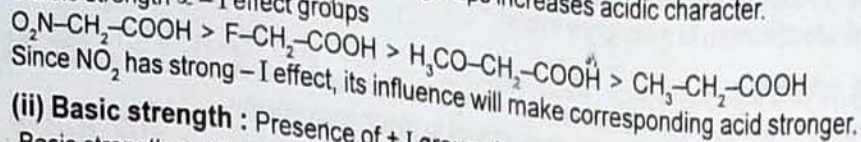
Direction of electron displacements



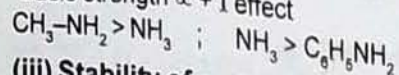


### Applications of Inductive effect :

(i) **Acidic strength** : Presence of -I groups increases acidic character.  
Acidic strength  $\propto$  -I effect groups

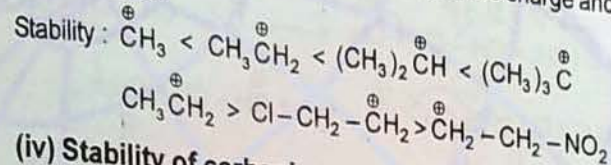


(ii) **Basic strength** : Presence of +I groups increases basic character.  
Basic strength  $\propto$  +I effect



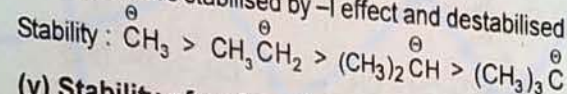
(iii) **Stability of carbocations** :

Carbocations are electron deficient species and they are stabilised by +I effect and destabilised by -I effect. Because +I effect tends to decrease the positive charge and -I effect tends to increase the positive charge on carbocation



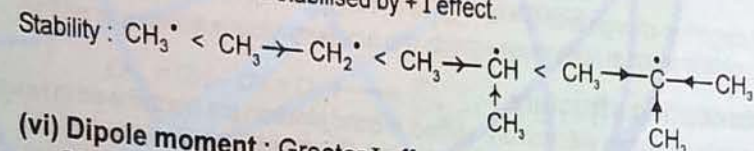
(iv) **Stability of carbanion** :

Carbanions are stabilised by -I effect and destabilised by +I effect.

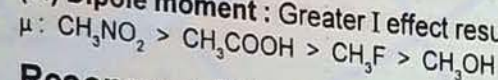


(v) **Stability of carbon free radical** :

Carbon free radicals are stabilised by +I effect.



(vi) **Dipole moment** : Greater I effect results in greater dipole moment.

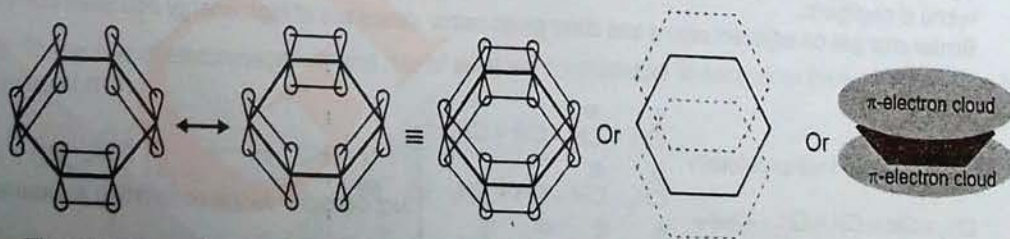
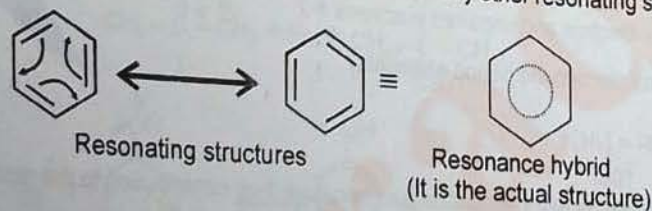


## 2. Resonance Effect :

When two or more structures that differ only in the distribution of electrons can be written for a molecule, no single Lewis structure is sufficient to describe its true electron distribution. The true structure is said to be a resonance hybrid of the various Lewis formulas.

The various Lewis formulas called resonating structure/contributing structure/canonical structure, that can be written for the molecule.

Resonating structures are hypothetical but contribute to the real structure, which is called resonance hybrid. The resonance hybrid is more stable than any other resonating structures.



The resonance structures are hypothetical and individually do not represent any real molecule. But they all contribute to a real structure which is called resonance hybrid.

The resonance hybrid is more stable than any resonating structure.  
 The most stable resonating structure contribute maximum to the resonance hybrid and least stable structure contribute minimum to resonance hybrid.

**Resonance energy :**

The P.E. difference between the most stable resonating structure and resonance hybrid is called resonance energy. The stability of molecule is directly proportional to resonance energy.

**Conditions for resonance :**

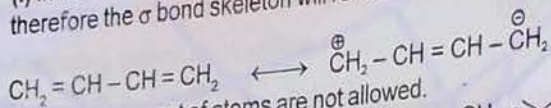
1. All atoms participating in resonance must be sp or sp<sup>2</sup> hybridised.
2. The parallel p-orbitals overlap to each other.
3. Molecule should have conjugated system (parallel p-orbitals system is called conjugate system)

**Types of Conjugation :**

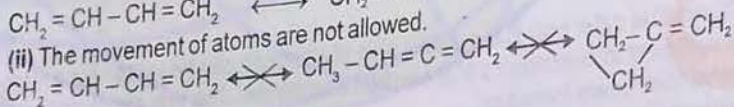
1. Conjugation between C = C and C = C (CH<sub>2</sub>=CH-CH=CH<sub>2</sub> ↔ <sup>⊕</sup>CH<sub>2</sub>-CH=CH-<sup>⊖</sup>CH<sub>2</sub>)
2. Conjugation between +ve charge and C = C (CH<sub>2</sub>=CH-<sup>⊕</sup>CH<sub>2</sub> ↔ <sup>⊕</sup>CH<sub>2</sub>-CH=CH<sub>2</sub>)
3. Conjugation between lone pair and C = C (: $\ddot{C}$ l-CH=CH<sub>2</sub> ↔ <sup>⊕</sup>Cl=CH-<sup>⊖</sup>CH<sub>2</sub>)
4. Conjugation between odd electron and C = C (CH<sub>2</sub>=CH- $\dot{C}$ H<sub>2</sub> ↔  $\dot{C}$ H<sub>2</sub>-CH=CH<sub>2</sub>)
5. Conjugation between negative charge and C = C (<sup>⊖</sup>CH<sub>2</sub>=CH-<sup>⊖</sup>CH<sub>2</sub> ↔ <sup>⊖</sup>CH<sub>2</sub>-CH=CH<sub>2</sub>)

**Rules for writing resonating structure :**

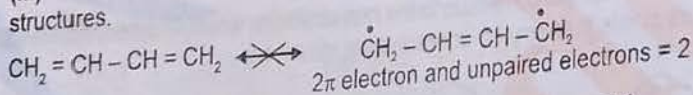
(i) In resonating structure only p-orbitals electron are shifted, σ bond electron are not involved in resonance therefore the σ bond skeleton will remain same in between the resonating structures.



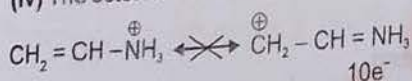
(ii) The movement of atoms are not allowed.



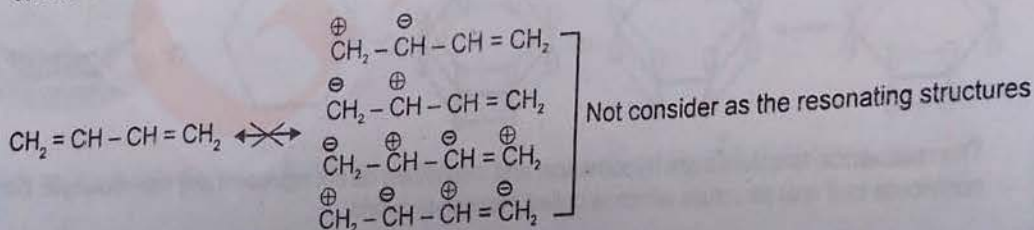
(iii) The no. of paired electrons are same and no. of unpaired electrons are also same in two resonating structures.



(iv) The octet rule should not violate (for second period elements).

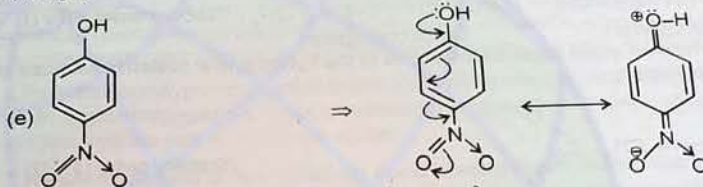
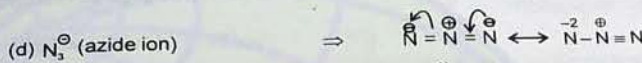
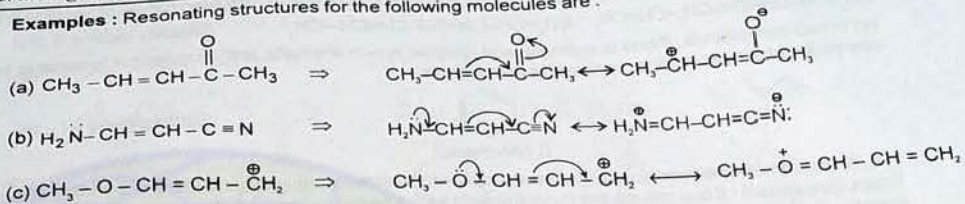


(v) High energy structures are rejected as resonating structure because their contribution to the resonance hybrid is negligible.  
 Similar charges on adjacent atoms and other given below cases are of high energy and least contributing structures.



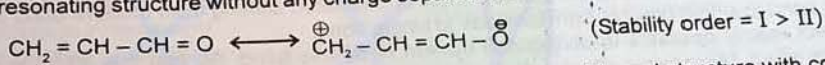
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Examples : Resonating structures for the following molecules are :

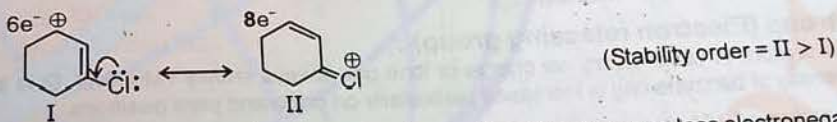


Rules for stability of resonating structure :

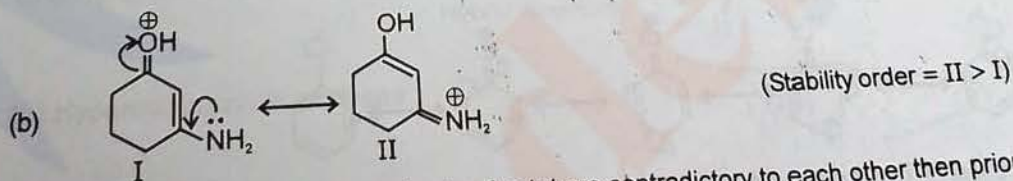
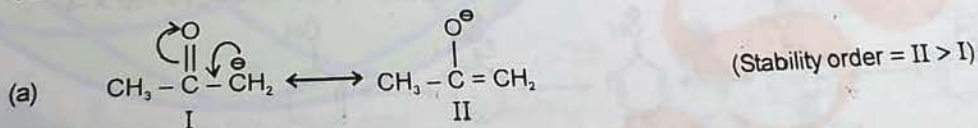
(i) The resonating structure without any charge separation is more stable.



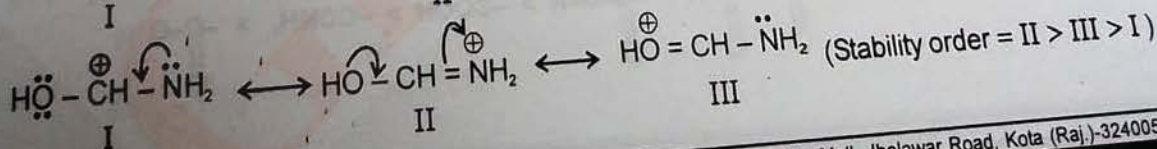
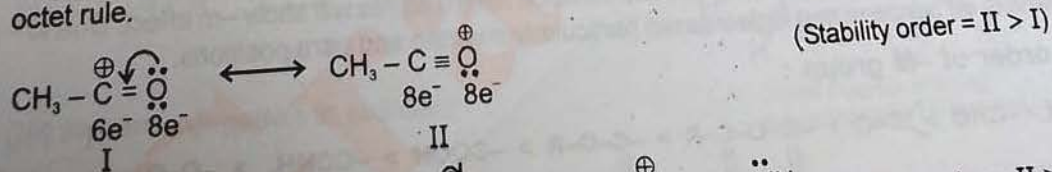
(ii) The resonating structure with more no. of  $\pi$  bonds is more stable and structure with complete octet at each atom is more stable.



(iii) Negative charge on more electronegative atom and positive charge on less electronegative atom is more stable.



Note : If the rule of electronegativity and rule of octet are contradictory to each other then priority is given to the octet rule.

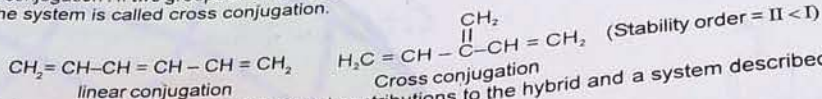


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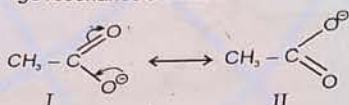
- (iv) Between two different compounds more conjugated is more stable (provided nature of bonding is same).  
 (Stability order = II > I)  
 $CH_2=CH-CH=CH-CH_2-CH=CH_2$      $CH_2=CH-CH=CH-CH=CH-CH_3$
- (v) In two compounds, if one is aromatic and another is non aromatic and conjugation is equal in both the compounds then aromatic compound is more stable.  
 (Stability order = I < II)



- (vi) Structure with linear conjugation is more stable than cross conjugation (nature of bonding is same).  
 Cross conjugation: If two groups are in conjugation with a particular group but not conjugated with each other then the system is called cross conjugation.



Note: Equivalent resonance structures make equal contributions to the hybrid and a system described by them has a large resonance stabilization.



(Stability order: I = II)

3. Mesomeric effect:

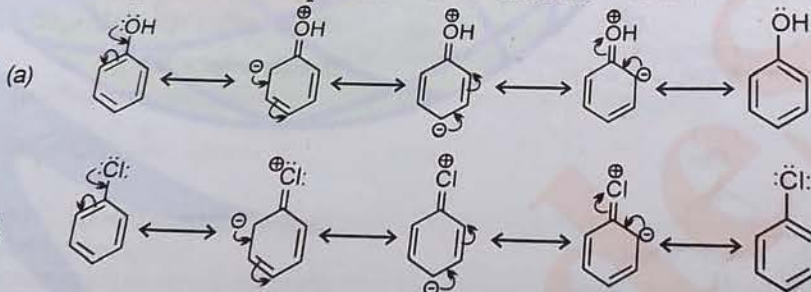
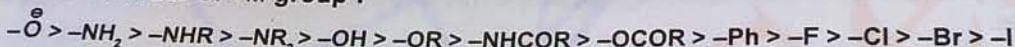
Mesomeric effect is defined as permanent effect of  $\pi$  electron shifting from multiple bond to atom or from multiple bond to single bond or from lone pair to single bond. This effect mainly operates in conjugated system of double bond. So that this effect is also known as conjugate effect. Mesomeric effect is distance independent.

- Types of Mesomeric effect:  
 (i) +M effect    (ii) -M effect

(i) +M group (Electron releasing group):

A group, first atom of which bears -ve charge or lone pair always shows +M effect. Due to +M effect the electron density of benzene ring is increased particularly on ortho and para positions.

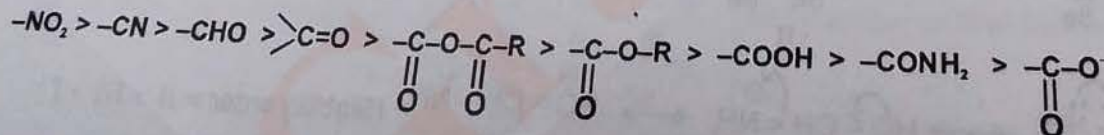
Relative order of +M group:



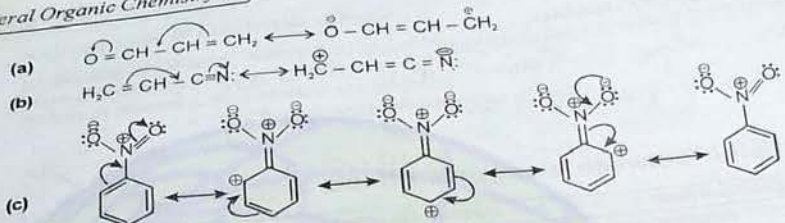
(ii) -M group (Electron withdrawing group):

A group that contains double bond or triple bond between hetero atoms will show -m effect. Due to -m the electron density on benzene ring is decreased particularly on ortho and para positions.

Relative order of -M group:



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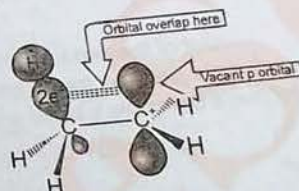
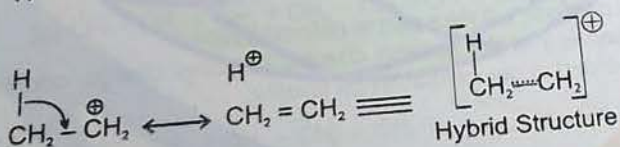
4. Hyperconjugation :

When a sigma C-H bond of  $\text{sp}^3$  hybridised carbon is in conjugation with  $\pi$ -bond (p-orbital), half filled p-orbital or vacant p-orbital, then the bond pair  $e^-$  of sigma C-H bond overlap with adjacent p-orbital. This phenomenon is called hyperconjugation. It may take place in alkene, alkynes, carbocations and carbon free radicals.  
 Like resonance hyperconjugation is also a stabilising effect but **the effect of resonance is more dominating than hyperconjugation**, since in resonance only p-orbital overlap while in hyperconjugation  $\sigma$  molecular orbitals overlap with p- molecular orbital.

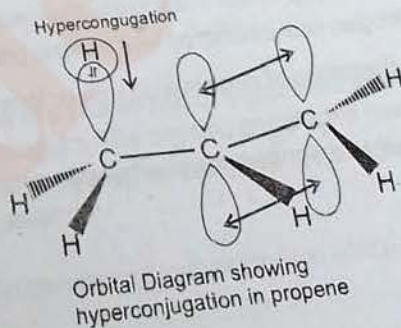
- \* Hyperconjugation is also called **no bond resonance or Baker Nathan Effect**.
  - \* Number of hyperconjugative structure = Number of  $\alpha$ -hydrogen atoms at  $\text{sp}^3$  hybridised  $\alpha$ -carbon atoms.
  - \* **Condition** :  $\text{sp}^3$  hybrid C-H or C-D must be present adjacent to the  $\text{C}^*/\text{C}=\text{C}/\text{C}\equiv\text{C}$ .
- Important points :**
- (i) It is distance independent.
  - (ii) Not applicable at carbanion.
  - (iii) Hybridisation of atoms remains unchanged.
  - (iv) It is a permanent effect.

| Structure  | Number of $\alpha$ -hydrogens | Structure   | Number of $\alpha$ -hydrogens |
|--|-------------------------------|---|-------------------------------|
| $\text{CH}_3-\text{CH}=\text{CH}_2$                | 3                             | $\text{H}_3\text{C}-\overset{\oplus}{\text{C}}-\text{CH}_3$             | 9                             |
| $\text{CH}_3-\text{CH}_2-\text{CH}=\text{CH}_2$    | 2                             | $\text{H}_2\text{C}-\overset{\oplus}{\text{C}}-\text{CH}_2-\text{CH}_3$ | 8                             |
| $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$      | 6                             | $\text{CH}_3-\overset{\oplus}{\text{C}}-\text{CH}_3$                    | 3                             |
| $\text{CH}_3-\overset{\oplus}{\text{C}}\text{H}_2$ | 3                             |   |                               |

(i) Hyperconjugation in carbocation :



(ii) Hyperconjugation in alkene :



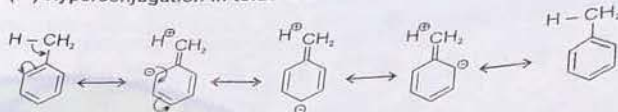
(iii) Hyperconjugation in radical :





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(iv) Hyperconjugation in toluene :

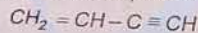


5. Comparison between electronic effects :

| Inductive effect   | Mesomeric effect  | Hyperconjugative effect   |
|--|---|---|
| (1) It is found in saturated and unsaturated compounds.  | (1) It is found in unsaturated compounds especially having conjugated system.   | (1) It is found in carbocation, carbon free radical and unsaturated compounds.  |
| (2) It involves partial shifting of sigma electrons.   | (2) It involves complete shifting of pi-electrons of pi-bonds or lone pair of electrons.                                  | (2) It involves partial shifting of sigma-electrons into adjacent p-orbital.  |
| (3) The electron pair is slightly displaced from its position and thus partial charges are developed.                                | (3) The electron pair is completely transferred and thus full positive and negative charges are developed.                | (3) The electron pair is partially transferred.   |
| (4) It is transmitted over a quite short distance. The effect becomes negligible after third atom in the chain (distance dependent). | (4) It is transmitted from one end to other end of the chain provided conjugation is present. It is distance independent. | (4) It is transmitted from one end to other end of the chain provided conjugation is present. It is distance independent. |

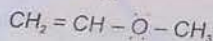
Important points :

(a) If any group has more than one  $\pi$  bond in conjugation, then only one  $\pi$  bond will take part in delocalisation.



Out of two  $\pi$  bonds only one  $\pi$  bond will take part in delocalisation.

(b) If any conjugate position has more than one lone pair then only one lone pair will take part in the delocalisation.



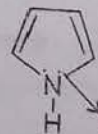
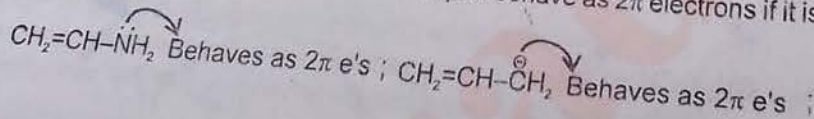
Out of the two lone pair 's only one will take part in delocalisation.

(c) If any conjugate position has  $\pi$  bond and any of the positive charge, negative charge, odd electron, lone pair electrons then only  $\pi$  bond will take part in delocalisation on priority.



Nitrogen has  $\pi$  bond as well as lone pair, but only  $\pi$  bond of nitrogen will take part in delocalisation.

(d) Electrons of negative charge or lone pair behave as  $2\pi$  electrons if it is in conjugation to  $\pi$  bond.

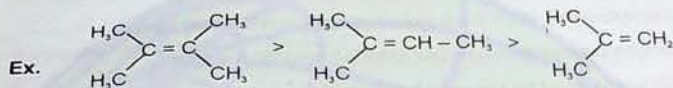


behaves as  $2\pi$  e's

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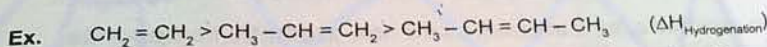
**Applications of Electronic effects :**

More substituted alkenes are more stable. Stability of alkenes  $\propto$  delocalisation of  $\pi$  electrons  $\propto$  no. of hyperconjugative structures



(b) **Heat of hydrogenation** : Greater the number of  $\alpha$  hydrogen results greater stability of alkene. Thus greater extent of hyperconjugation results lower value of heat of hydrogenation

Stability of alkenes  $\propto$  no. of hyperconjugative structures  $\propto \frac{1}{\Delta H_{\text{Hydrogenation}}}$

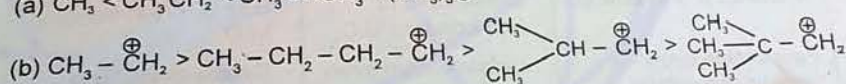
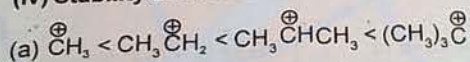


(iii) **Bond Length** : Bond length is also affected by hyperconjugation



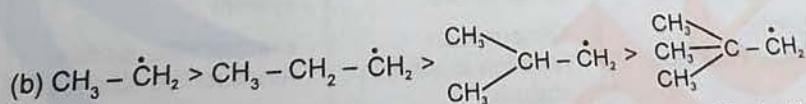
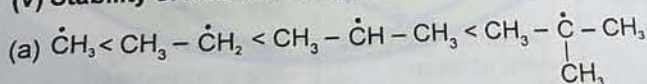
- (a) Bond length of C(II) – C(III) bond is less than expected
- (b) Bond length of C(II) – C(I) bond is more than expected
- (c) C – H bond is longer than expected

(iv) **Stability of carbocation** : Greater number of ' $\alpha$ ' hydrogen atoms, greater will be stability of carbocations.



(due to resultant of inductive effect and hyperconjugation)

(v) **Stability of free radical** : More the number of  $\alpha$ -hydrogen atoms, more will be stability of carbon free radical

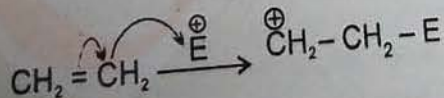


(due to resultant of inductive effect and hyperconjugation)

**6. Electromeric effects :**

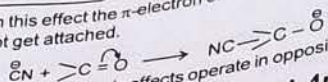
It is a temporary effect. It is defined as the complete transfer of a shared pair of  $\pi$ -electrons to one of the atom joined by a multiple bond on the demand of an attacking reagent. The organic compound having a multiple bond ( double or triple bond) show this effect in the presence of an attacking reagent only. It is represented by E and the shifting of the electrons is shown by a curved arrow. There are two types of electromeric effect.

(i) **+E effect** : In this effect  $\pi$ -electron of the multiple bond transferred to that atom at which the reagent gets attached.



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(ii) -E effect: In this effect the  $\pi$ -electron of the multiple bond transferred to that atom at which the attacking reagent does not get attached.






Note: When inductive and electromeric effects operate in opposite directions then the electromeric effect dominates.

7. Aromatic Character : [The Huckel  $4n + 2$  rule]

Aromatic compounds have characteristic smell, have extra stability and burn with sooty flame. Based on the properties of aromatic compounds there are four criteria about the  $\pi$ -system.

- (i) Complete conjugated system (all atoms must be  $sp^2$  or  $sp$  hybridised).
- (ii) Cyclic.
- (iii) Planar.
- (iv) Huckel rule:  $(4n + 2)$   $\pi$  electrons in the cyclic conjugated  $\pi$ -system. Where  $n =$  an integer  $0, 1, 2, 3, \dots$

Comparison between aromatic, anti aromatic and non-aromatic compounds.

| Characteristics                   | Aromatic compounds (A)  | Anti Aromatic compounds (B)   | Non-Aromatic compounds (C)  |
|-----------------------------------|---|---|---|
| Example                           |  |  |  |
| 1. Structure                      | Cyclic, planar all atoms of ring $sp^2$ hybridised                                | Cyclic, planar all atoms of ring $sp^2$ hybridised                                | Cyclic or acyclic, planar or non planar, $sp$ or $sp^2$ or $sp^3$                   |
| 2. No. of $\pi e^-$ s in the ring | $(4n + 2)\pi e^-$ (Huckel's rule)   | $(4n)\pi e^-$   | Any no. of $\pi e^-$ s  |
| 3. MOT                            | Unpaired $e^-$ s in B.M.O.  | Some $\pi e^-$ s in non-bonding M.O.  | B.M.O. / Non-bonding M.O.   |
| 4. Overlapping                    | Favourable overlapping of p orbital   | Unfavourable overlapping of p orbital   | Simple overlapping like alkenes   |
| 5. Resonance energy (R.E.)        | Very high R.E. $> 20-25$ kcal/mol   | Zero  | 4-8 kcal/mol like alkenes   |
| 6. Stability                      | Have extra stability due to close conjugation of $\pi e^-$ s                      | Unstable, does not exist at room temperature                                      | Normal stability like a conjugated system   |
| 7. Characteristic Reactions       | Electrophilic substitution Reaction   | Dimerisation reaction to attain stability   | Electrophilic addition reaction like alkenes  |

Stability of compounds = Aromatic compound  $>$  Non-Aromatic compound  $>$  Anti-Aromatic compound

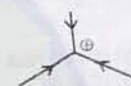
**Exercise-1**

Marked Questions may have for Revision Questions.

**OBJECTIVE QUESTIONS**

**Section (A) : Inductive effect**

A-1. How many following molecules / ions show correct direction of inductive effect.

- I.  $\text{CH}_3 \rightarrow \text{CH}_2 \rightarrow \underset{\downarrow \text{F}}{\text{CH}} \rightarrow \text{CH}_2 \rightarrow \text{CH}_3$  ✗
- II.  $\text{CH}_3 \leftarrow \overset{\ominus}{\text{C}}\text{H}_2$  ✓
- III.  $\text{Cl} \rightarrow \text{CH} = \text{CH}_2$  ✗
- IV.  $\text{CH}_3 \rightarrow \text{CH} = \text{CH}_2$  ✓
- V.  $\text{CH}_3 \rightarrow \text{Li}$  ✗
- VI.  $\text{CH}_3 \leftarrow \text{MgBr}$  ✓
- VII.  $\text{CH}_3 \rightarrow \text{CH}_2 \rightarrow \text{OH}$  ✓
- VIII.  $\text{CH}_3 \leftarrow \overset{\ominus}{\text{O}}$  ✓
- IX.  $\text{CH}_3 \rightarrow \overset{\oplus}{\text{N}}\text{H}_3$  ✓
- X.  ✓

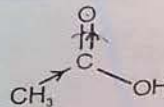
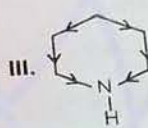
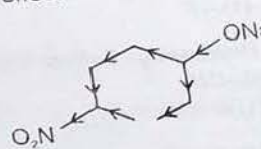

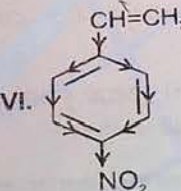
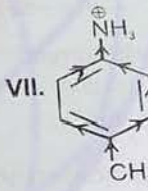
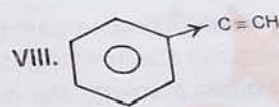
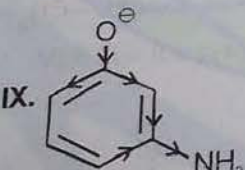
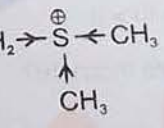
(1) eight

(2) ten

(3) seven

(4) six

A-2. How many following molecules / ions show correct direction of inductive effect.

- I. 
- II.  $\text{CH}_3 \leftarrow \text{COO}^\ominus$
- III. 
- IV. 
- V. 
- VI. 
- VII. 
- VIII. 
- IX. 
- X.  $\text{CH}_3 \rightarrow \text{CH}_2 \rightarrow \text{CH}_2 \rightarrow \overset{\oplus}{\text{S}} \leftarrow \text{CH}_3$   


(1) ten

(2) seven

(3) eight

(4) six

A-3. Inductive effect involves :

- (1) delocalisation of  $\sigma$ -electrons  
 (2) delocalisation of  $\pi$ -electrons  
 (3) displacement of  $\sigma$ -electrons  
 (4) displacement of  $\pi$ -electrons

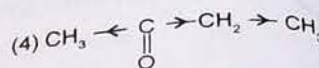
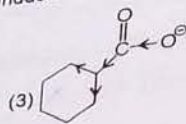
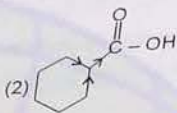
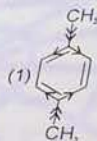
A-4. Which statement is correct regarding Inductive effect ?

- (1) Electron displacement along a carbon chain and develops partial charges on atoms.  
 (2) Complete transfer of one of the shared pair of electrons to one of the atom joined by a double bond.  
 (3) Implies transfer of lone pair of electron from more electronegative atom to the less electronegative atom.  
 (4) I effect increases with increase in the distance.

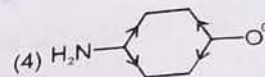
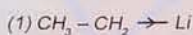
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- A-5. Select the correct statement about Inductive effect:  
 (1) Inductive effect transfer electrons from one carbon atom to another.  
 (2) Inductive effect is the polarisation of  $\sigma$  bond electrons.  
 (3) Net charge develops in the molecule by inductive effect.  
 (4) Inductive effect is distance independent.

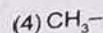
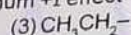
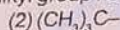
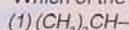
- A-6. Which of the following has incorrect direction of Inductive effect.



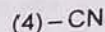
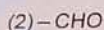
- A-7. Which of the following has correct direction of Inductive effect.



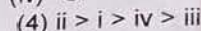
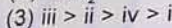
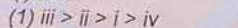
- A-8. Which of the following alkyl group has the maximum +I effect?



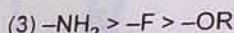
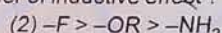
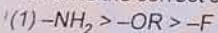
- A-9. Which of the following group shows + I effects:



- A-10. Decreasing -I effect of given groups is:



- A-11. Which is the correct order of inductive effect?



- A-12. Which of the following statement is correct?

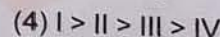
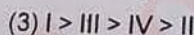
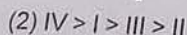
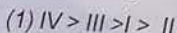
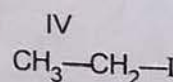
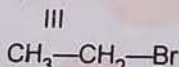
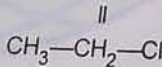
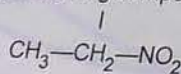
(1) +I group stabilises the carbocation.

(2) +I group stabilises the carbon free radical

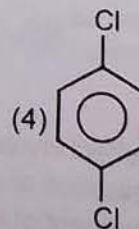
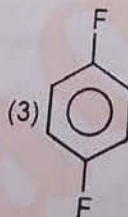
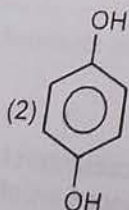
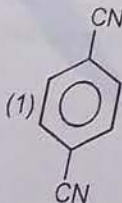
(3) -I group stabilises the carbanion

(4) all of these

- A-13. Arrange following compounds in decreasing order of their dipole moment.



- A-14. Which compound has non-zero dipole moment?



Section (B) : Resonance

- B-1. Resonance effect involves:

- (1) Delocalization of  $\pi$ -electrons along a conjugated system.  
 (2) Delocalization of lone pair along a conjugated system.  
 (3) Delocalization of negative charge along a conjugated system.  
 (4) All are correct.

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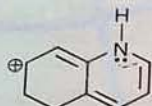
B-2. Resonance structures of a molecule do not have:  
 (1) Identical bonding (2) Identical arrangement of atoms  
 (3) The same number of paired electrons (4) Nearly the same energy content

B-3. In which of the following delocalisation of  $\pi$ -electron is possible.  
 (1)  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CHO}$  (2)  $\text{CH}_2=\text{CH}-\text{CH}=\text{O}$  (3)  $\text{CH}_3-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$  (4)  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}=\text{CH}_2$

B-4. Which of the following compound show resonance?

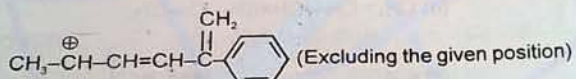


B-5. Number of delocalised  $\pi$  electrons in the following structure is.



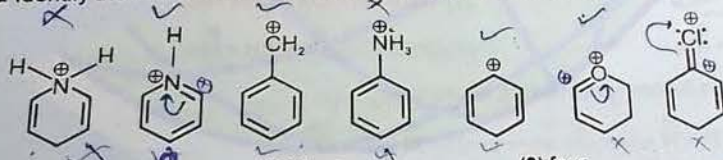
- (1) six (2) eight (3) four (4) ten

B-6. Find the total number of positions where positive charge can be delocalized by true resonance.



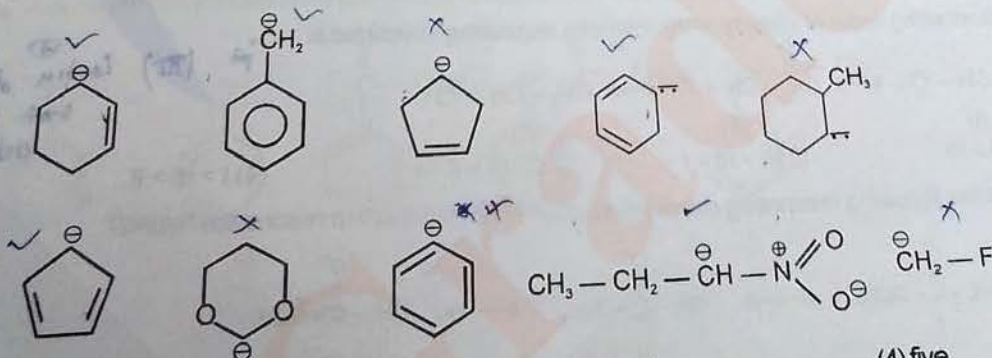
- (1) four (2) eight (3) two (4) six

B-7. Identify the number of compounds in which positive charge will be delocalised?



- (1) two (2) three (3) four (4) five

B-8. How many of the following species, the negative charge is delocalised?

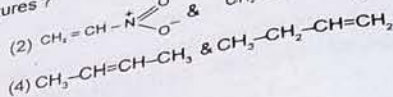
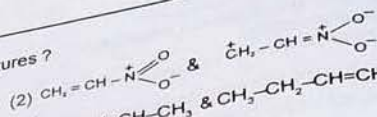
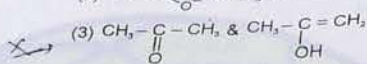
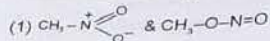


- (1) seven (2) four (3) six (4) five

B-9. In which compound delocalisation is not possible:  
 (1) 2-Butene (2) 1, 3-Butadiene (3) 1, 3, 5-Hexatriene (4) Benzene

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B-10. Which of the following pairs are resonating structures?



B-11. Stability of  $\overset{\oplus}{\text{C}}\text{H}_2-\text{CH}=\text{CH}_2$  can be explained by:

(1) Inductive effect

(2) Electromeric effect

(3) Resonance

(4) Polar effect

B-12. How many equally stable resonating structures are possible for  (tropylium cation)?

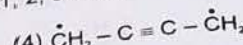
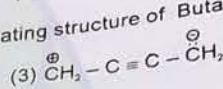
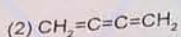
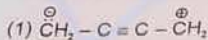
(1) 2

(2) 4

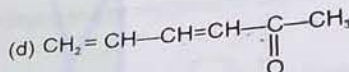
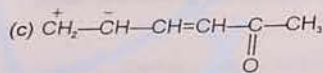
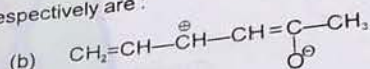
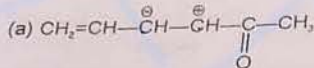
(3) 5

(4) 7

B-13. Which of the following is not acceptable resonating structure of Buta-1, 2, 3-triene.



B-14. The least and most stable resonating structure respectively are:



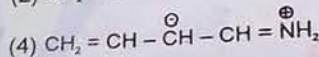
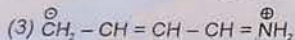
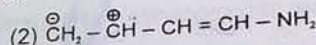
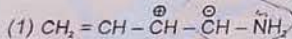
(1) a, d

(2) b, c

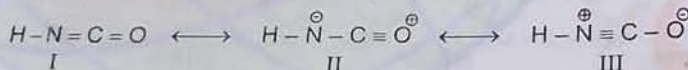
(3) d, a

(4) c, b

B-15. Which will be the least stable resonating structure:



B-16. HNCO (isocyanic acid) has following resonating structures:



The order of stability is:

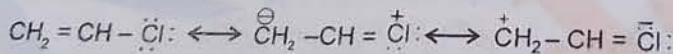
(1) I > III > II

(2) I > II > III

(3) II > III > I

(4) II > I > III

B-17. The decreasing order of stability of the following resonating structures is:



(I)

(II)

(III)

(1) I > II > III

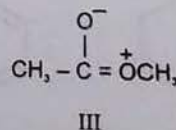
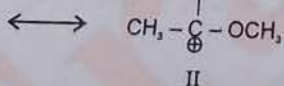
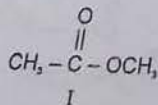
(2) II > III > I

(3) III > II < I

(4) I > III > II

*(III) Carbon does not have octet complete*

B-18. Which of the following resonating structure will contribute minimum to resonance hybrid?



(1) I

(2) II

(3) III

(4) All structures contribute equally

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