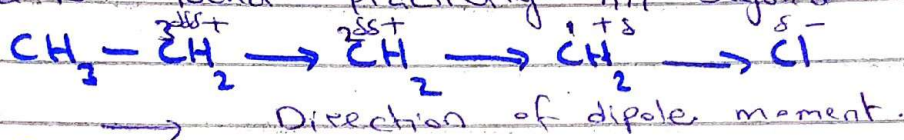


## =: Explain the difference between Inductive and

### field effects:

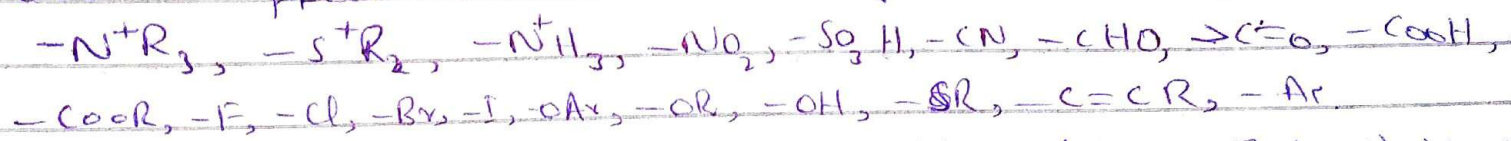
Inductive effect: Inductive effect is a permanent effect, caused by the displacement of  $\sigma$ -electrons along the covalent bonds,  $\overline{\text{PB}}$  because of different electron sharing properties of bonded atoms or groups. The difference in electron sharing properties is due to different electronegativity values of bonded atoms resulting in the polarization of the bonds. This polarization of one bond caused by the polarization of an adjacent bond is called inductive effect. This effect gradually decreases with distance from its source and is found practically nil beyond  $C_3$ .



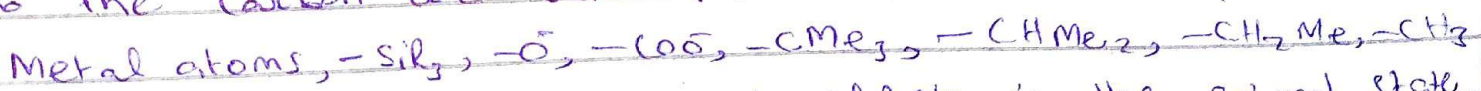
=> Types of Inductive effect: (1) -I group (2) +I group.

Depending upon the direction of  $e^-$  movement inductive effect may be classified as negative and positive.

=: Negative inductive effect: Atoms or groups that withdraw electrons towards themselves are called negative inductive effect. known as -I group.



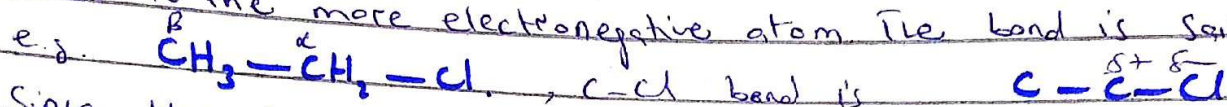
=: Positive inductive effect: While these push electrons to the carbon are said positive inductive effect.



=: Inductive effect is permanent effect in the ground state of molecule and usually operates through single bonds. However transmitted through space or solvent molecules.

## =: Field effect and + Inductive effect:

The effect that operates not through bonds, but directly through space, is called field effect.  $\Rightarrow$  It depends on the geometry of the molecule, while inductive effect depends on the nature of bond.  $\Rightarrow$  It has been pointed out that when there is a covalent bond between two unlike atoms, the bonding  $e^-$  pair is nearer to the more electronegative atom. The bond is said to be polarized.



Since the  $\alpha$ -carbon atom bears a partial positive charge, it will attract the electron cloud between it and the  $\beta$ -carbon more to itself, i.e. The electron cloud between  $\text{C}_\alpha$  and  $\text{C}_\beta$  will lie closer to the  $\alpha$ -carbon and thus create a partial positive on the  $\beta$ -carbon. The  $\beta$ -carbon, in turn, will have greater attraction for the bonding electron pair between it and a  $\beta$ -hydrogen atom. Therefore, the electron cloud between the  $\beta$ -carbon and a  $\beta$ -hydrogen will lie closer to the  $\beta$ -carbon creating a partial positive charge on the  $\beta$ -hydrogen. Thus a polar bond between two unlike atoms indicates charge separation in the adjacent bond and even further along a chain.

## =: Applications of Inductive effect:

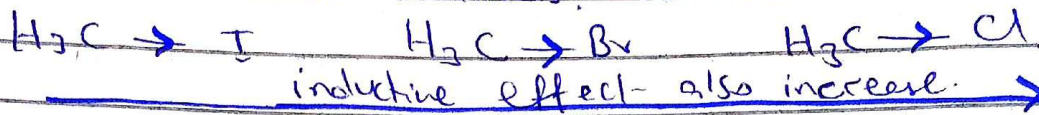
1) Reactivity of Alkyl Halides: The presence of halogen atoms in the molecule of an alkyl halides creates a centre of low ~~at~~ electron density on the adjacent carbon which is readily attacked by the negatively charged reagents.



2) Effect on bond length: Bond length decreases with increase in inductive effect, perhaps, the covalent-bond assumes increased ionic character.

The bond length as  $C-F < C-Cl < C-Br < C-I$

(3) Dipole Moment:- An Inductive effect increases the dipole moment also increases.



Inductive effect refers to the polarization of electron density along a sigma bond.

Inductive effect is distance dependent.

IE is observed in the decreasing electron density in a molecule due to electronegative atom pulling  $e^-$  density towards itself.

Field effect refers to the influence of an electric field on the distribution of  $e^-$ .

Field effect does not distance dependent.

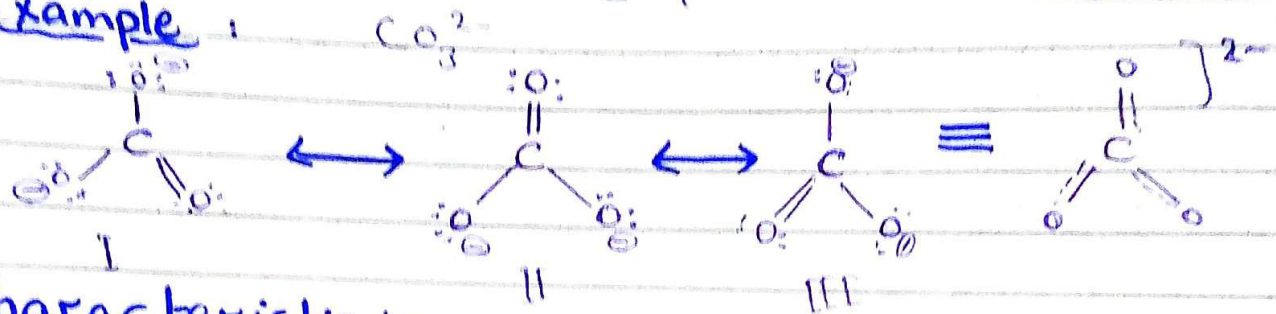
Field effect is observed in the redistribution of  $e^-$  in a molecule when an electric field is applied.

Q.1) Define Resonance and Resonance effect.

### Defination:

- 1. Resonance is a way of Describing bonding in certain molecules or ions by the contribution of several contributing structure.
- 2. When a molecule is represented by two or more, structure and that structure are differ in position of electron not in position of atoms, then the structure is called resonating structure and the phenomena is Resonance.

### → Example :



### → Characteristic :-

1. Each atom have a noble gas configuration.
2. Structure are interconvertible.  $e^-$  pair movement, remaining the nuclear position is unchanged.
3. Represented by a curve arrow.
4. I, II, III, are equal in Paper.
5. Double bond is changing its position with single bond.
6. All the CO bond are equivalent on the basis of bond length.
7. Each CO have distance 1.28 Å.
8. Negative charge is equally distributed over all three oxygen.
9. Greater the number of resonating structure greater will be stability.

## ⇒ Rules For Resonance:

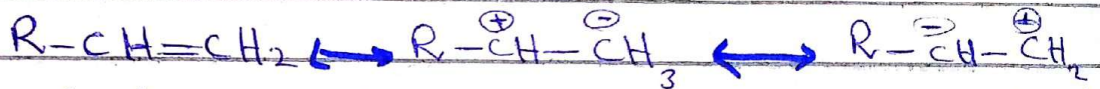
1. All the canonical structure must be written according to Lewis method showing bonds, lone pair and formal charge where required.
2. Position of atomic nuclei of the chemical species must remain unchanged in all resonating species.

### Example:



3. The no of unpaired  $e^-$  in each of sub structure must be same.

### Example:-



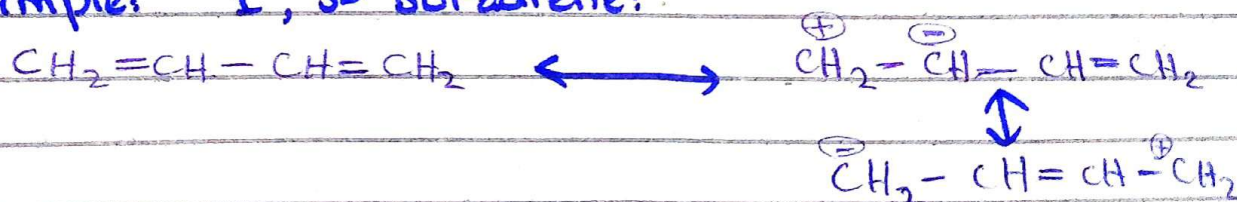
4. All the atoms involve in the resonance must lie in the same plane and nearly same. Any charge in structure which prevent planarity will diminish resonance.

## → Contribution of Resonance Structure in Resonance Hybrid.

The most stable resonating structure contribution most and the least stable structure contribution least in the resonance hybrid. Stability of resonance structure can be known by following rule.

Rule 1: resonating structure with more covalent bond are normally more stable than those with fewer covalent bond.

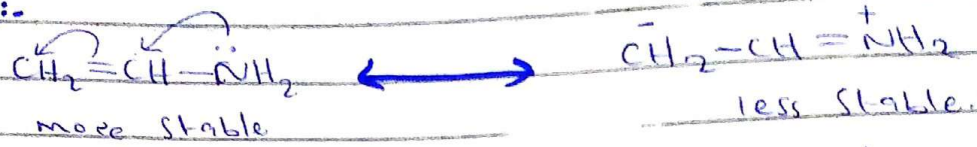
∴ Example: 1, 3- Butadiene:



Rule 2: If the different resonating structure have

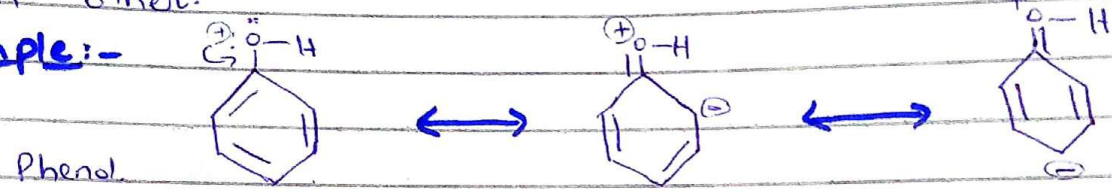
have same number of covalent bond, then uncharged structure have major contribution in resonance hybrid.

=> Example:-



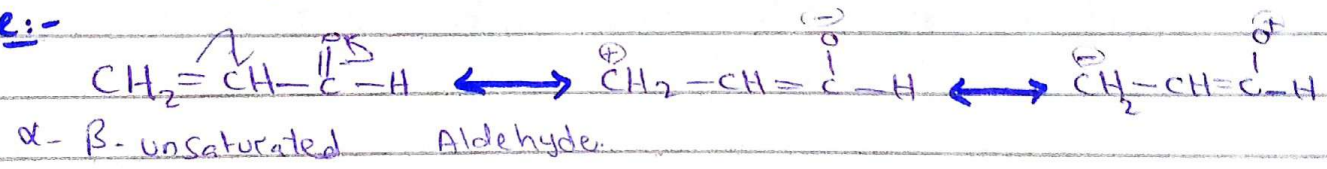
=> Rule:3. Structure with isolate unlike charge has less contribution than those in which they are close to each other.

Example:-



=> Rule:4. Structure with negative formal charge on most electronegative atom and positive on least electronegative atom have significant contribution.

Example:-



=> Q.1(b). Write short note on followings.  
 (1) Tautomerism (2) Hyperconjugation.

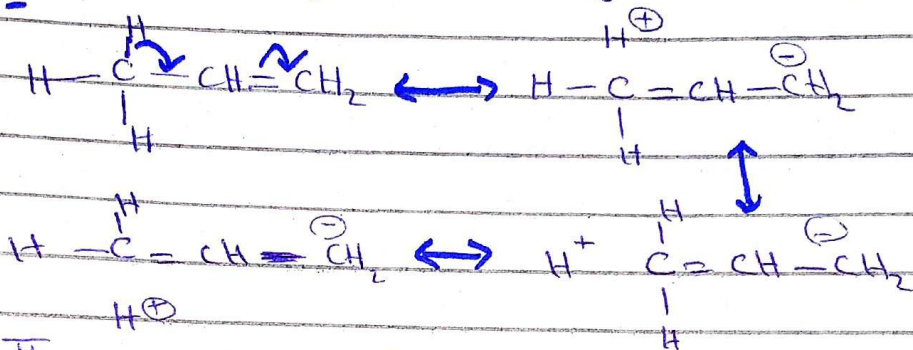
2. Hyperconjugation:- Whenever C-H bond is directly attached to an unsaturated carbon or benzene ring the sigma electron of C-H bond move into conjugation with the unsaturated carbon or benzene ring is called Hyperconjugation.

## Structure Requirements of Hyper Conjugation:

Any organic species can show hyper conjugation phenomena if it fulfilled following conditions.

1. Compound should have a  $sp^2$  hybrid carbon of alkenes, arenes, carbocation and free radical.
2. Alpha carbon w.r.t  $sp^2$  hybrid carbon should have at least one hydrogen and hybrid of alpha carbon  $sp^3$ .

Example:-



- Note:
1. The number of hyperconjugated structures is equal to number of alpha H present in the compound.
  2. Greater the number of hyperconjugation structure will be the stability of the compound.

### Types of Hyperconjugation:-

(1) Sigma (C-H), Pi conjugation: This kind of conjugation occur in alkenes and alkyl substituted aromatic compounds.

(2) Sigma (C-H), Positive charge conjugation: This type of conjugation occur in allyl carbocation.

(3) Sigma (C-H), odd  $e^-$  conjugations: In alkyl free radical overlap take place b/w MO of C-H bond and incomplete orbitals of the adjacent carbon. Here extended orbital enclosed the two carbon and one hydrogen.

=: Note: Hyperconjugation  $\alpha$  stability.  
 Total no. of hyperconjugation in structure      no. of  $\alpha$  H's

=: Effect of Hyperconjugation:-  
 Like resonating hyperconjugation is also used to explain the property in term of structure formula but its magnitude is much smaller than resonance. This hyperconjugation is also be regarded as 2nd order resonance.

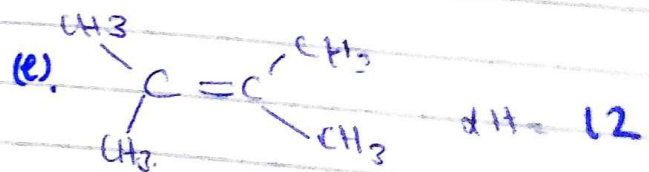
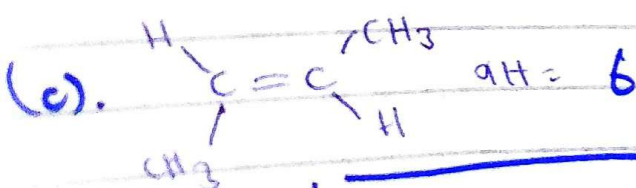
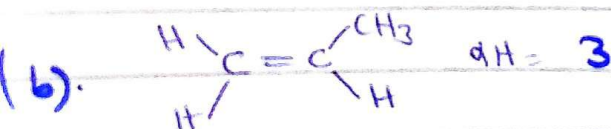
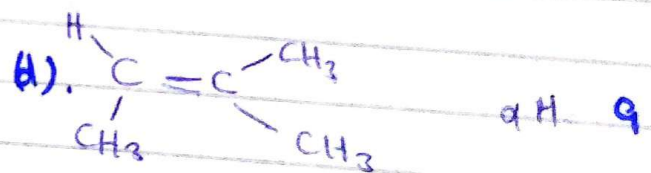
=: Stability of Alkene:-

→ We know that, more the  $\alpha$  H more will be hyperconjugation and so will be stability  
 ⇒ that's why tetra substituted alkenes is most stable and ethylene is less stable.

=: directive nature of alkyl group:-

The directive nature of alkyl group can be explained with the help of hyper conjugation. Due to hyperconjugation  $e^-$  density increase at ortho and para position of  $CH_3$  group. hence it is stable for  $\ominus$  electrophilic substitution at o and p.

=: Stability of alkenes:-

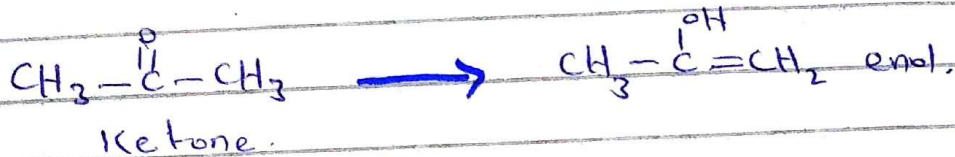
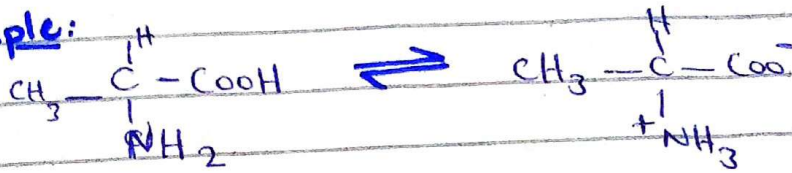




## (iv) Tautomerism

The type of isomerism which arise due to shifting of proton within a molecule is called Tautomerism.

=: Example:



Ketone.

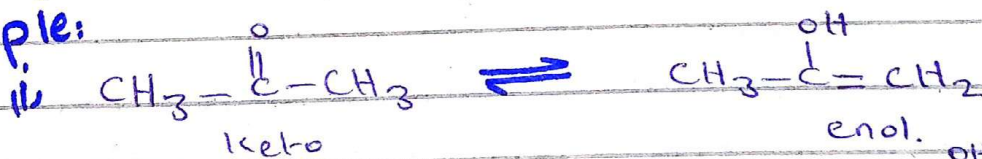
### → Requirement of Tautomerism:-

- A compound should be polar and has slightly acidic group.
- Change in position of proton occur.
- Tautomerism has no effect on bond length or such feature.
- The molecule is may be a planer or may not.

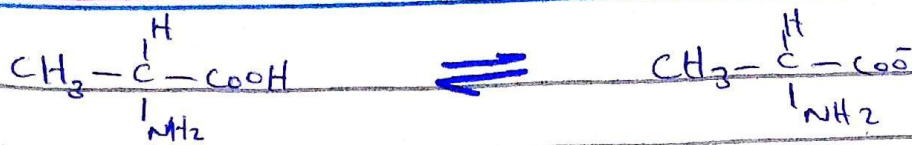
### → Types of Tautomerism:-

(1) Keto-enol Tautomerism:- The type of tautomerism arise due to conversion of keto form into enol form by the action small amount of Acid or base as a catalyst is called Keto-enol Tautomerism.

=: Example:

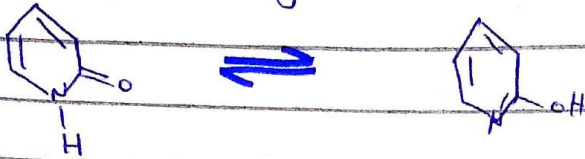


(2) Prototrophy:- The type of tautomerism arise due to only transfer of proton within a molecule such as amino acid is called Prototrophy.



### ⇒ Annular Tautomerism:-

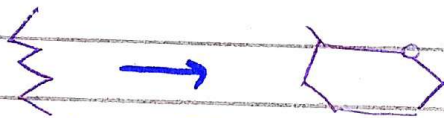
The type of tautomerism arise due shifting of e<sup>-</sup> in a heterocyclic system.



### ⇒ Ring chain Tautomerism:-

The type of isomerism arise when shifting of proton from open chain and converting into close chain/Ring is called Ring chain Tautomerism.

∴ Example: Conversion of D-Glucose into cyclic D-glucose.



### ⇒ Non-Carbonyl Tautomerism:-

If Carbonyl compound is not included, it is known as non-carbonyl Tautomerism.



⇒ Q No2. Explain the difference between Localized and Delocalized bonding

∴ Localized bond:- Localized bond as a covalent bond in which the electron density is concentrated between only two nuclei of

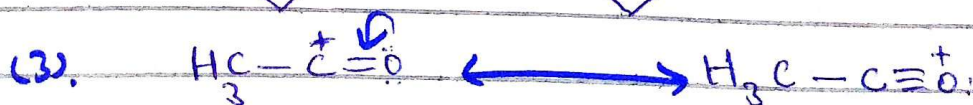
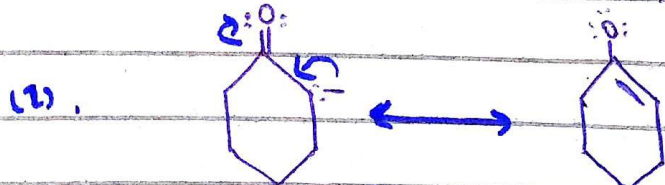
the bonding atoms.

=> delocalized bond:- The electron density is spread on more than two bonding atoms, then called delocalized bond

=> Points

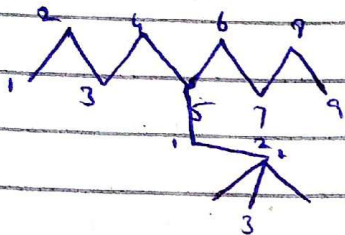
1. In molecule showing a delocalized chemical bonding can not represent by a single Lewis dot structure.
2. And this led the phenomena of resonance.
3. In vbt, to represent a molecule with chemical bonding we write two or more Lewis structure and say that the molecule is a resonance hybrid of these structure.
4. Benzene is a classical example of delocalized chemical bonding.
5. Benzene is consider to be resonance hybrid of structure I and II.
6. Resonance can be indicated by a double headed arrow and delocalization by circle.
7. Structure I and II are called canonical form and contributing structure.

=> delocalized bonding structure are.



⇒ Draw the structures of the following molecules.

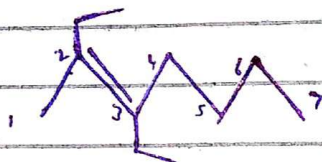
① 5-(2,2-Dimethylpropyl) nonane.



5-(2,2-Dimethylpropyl) nonane.

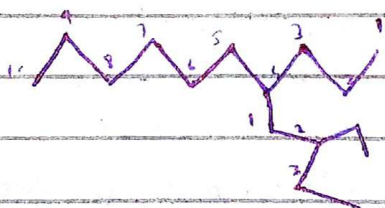
②.

2,3-Dimethylhept-3-ene.



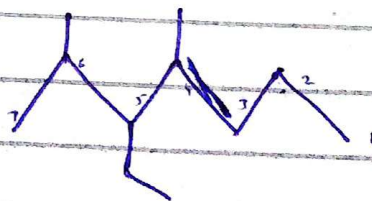
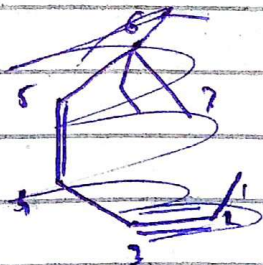
2,3-Dimethyl hept-3-ene.

③ 4-(2-Ethylbutyl) decane.



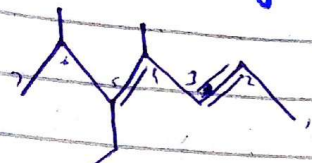
4-(2-Ethylbutyl) decane.

④ 5-Ethyl-4,6-dimethylhept-4-en-2-yne.



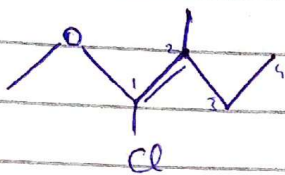
④ Draw the structure of

5-Ethyl-4,6-dimethylhept-4-en-2-yne.



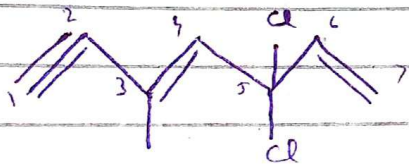
(5-Ethyl-4,6-dimethylhept-4-en-2-yne)

⑤ 1-chloro-1-methoxy-2-methylbut-1-ene.



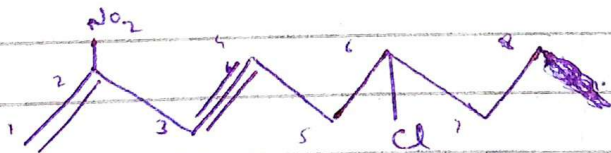
(1-chloro-1-methoxy-2-methylbut-1-ene)

⑥ 5,5-Dichloro-3-methylhepta-3,6-dien-1-yne.



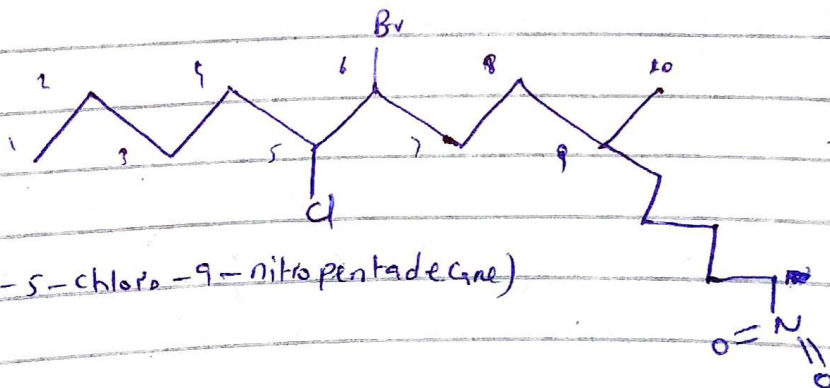
(5,5-Dichloro-3-methylhepta-3,6-dien-1-yne)

⑦ 6-chloro-2-nitrooct-1-en-3-yne.



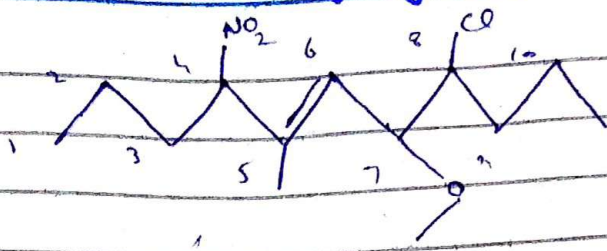
(6-chloro-2-nitrooct-1-en-3-yne)

⑧ 6-bromo-5-chloro-9-nitropentadecane.



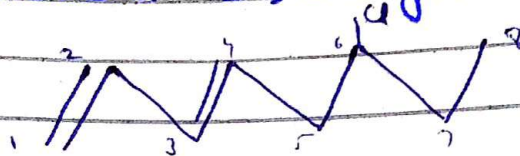
(6-bromo-5-chloro-9-nitropentadecane)

(9) 8-Chloro-7-methoxy-5-methyl-4-nitrodec-5-ene



(8-chloro-7-methoxy-5-methyl-4-nitrodec-5-ene)

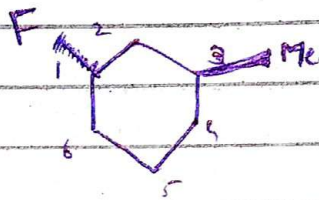
(10) 6-chloroocta-1,3-diene



(6-chloroocta-1,3-diene)

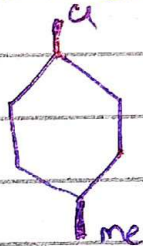
∴ Write the structural formula for more stable conformation of each of the following compound.

(a) trans-1-Fluoro-3-methylcyclohexane.



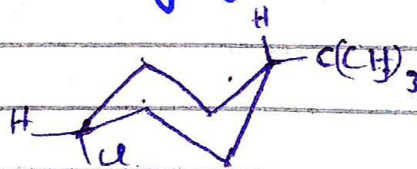
(trans-1-fluoro-3-methylcyclohexane)

(b) cis-1-Iodo-4-methylcyclohexane.



(cis-1-iodo-4-methylcyclohexane)

(c) cis-1-tert-Butyl-4-methylcyclohexane.



(d) cis-1,3,5-Trimethylcyclohexane.

