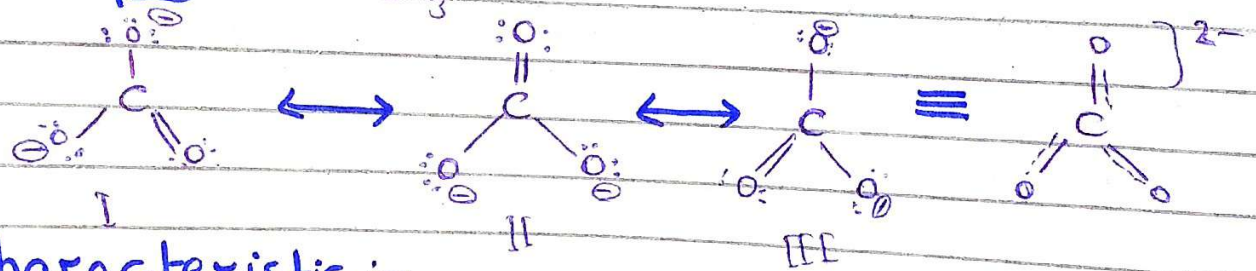
=: Q.1 Define Resonance and Resonance effect.

Defination:-

=: Resonance is a way of Describing bonding in certain molecules or ions by the by the contribution of severed Contributing Structure.

=: When a mdecule 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** : CO_3^{2-}



⇒. **Characteristic** :-

1. Each atom have a nobel gas configuration.
2. Structure are interconvertable 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 1.28A.
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:

$$CH_2=CH_2 \longleftrightarrow CH_3-\ddot{C}H$$

(I) (II)

3- the no of unpaired e^- in each of ~~subs~~ sutructure must be same.

Example:- $R-CH=CH_2 \longleftrightarrow R-\overset{\oplus}{C}H-\overset{\ominus}{C}H_3 \longleftrightarrow R-\overset{\ominus}{C}H-\overset{\oplus}{C}H_2$

4. All the atoms involve in the resonance must lie in the same plane and nearly same Any change in structure which prevent planarity will diminish ~~reseu~~ 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 normaly more stable then those with fewer covalent bond.

Example: 1, 3- Butadiene:

$$CH_2=CH-CH=CH_2 \longleftrightarrow \overset{\oplus}{C}H_2-\overset{\ominus}{C}H-CH=CH_2$$

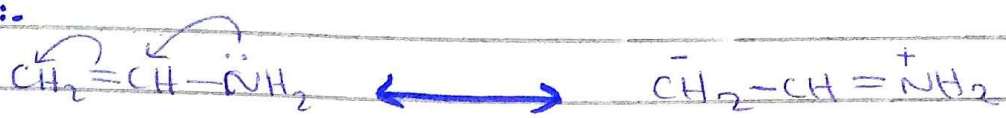
$$\updownarrow$$

$$\overset{\ominus}{C}H_2-CH=CH-\overset{\oplus}{C}H_2$$

Rule 2: If the different resonating structure have

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

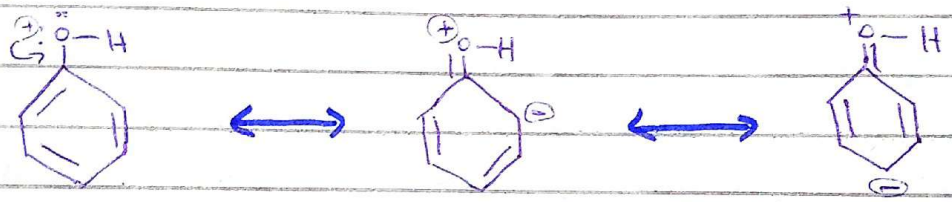
=: **Example:-**



more stable — less stable.

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

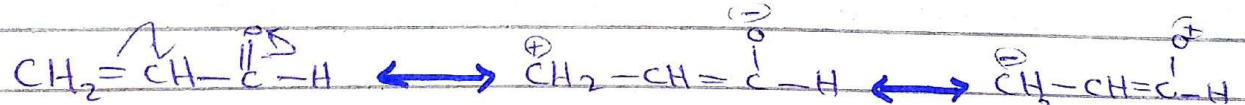
Example:-



Phenol.

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

Example:-



α- β- unsaturated Aldehyde.

=: **(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.

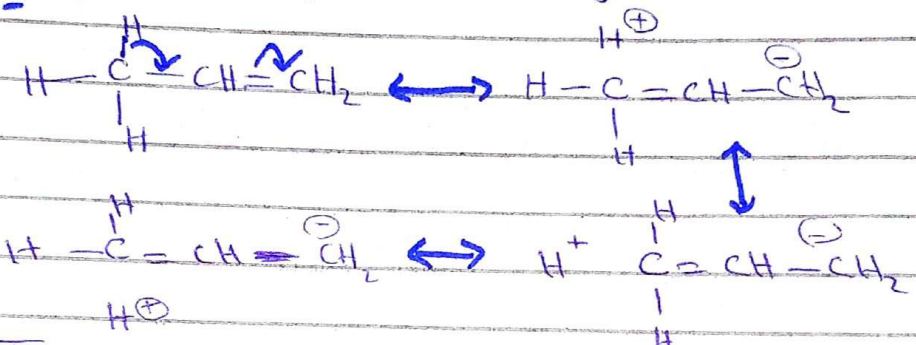
∴ Structure requirements of hyper conjugation:-

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

1- Compound should have a sp^2 hyb 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 hyb 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 compound.

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

(3). **Sigma (C-H), odd e conjugation:** 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 ∝ Stability.

Total no. of hyperconjugation in structure = no. of alpha H + 1

=: **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 hyper-conjugation 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.

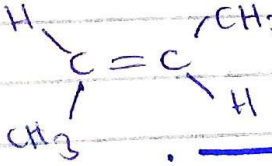
=: **directive nature of alkyl group:-**

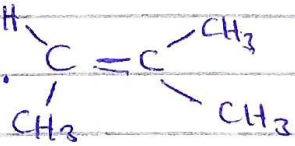
The directive nature of alkyl group can be explained with the help of hyperconjugation. Due to hyperconjugation e^- density increase at ortho and para position of CH_3 group. hence it is stable for ⊖ electrophonic substitution at o and p.

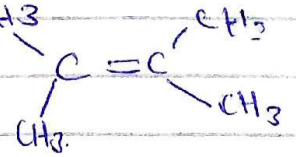
=: **Stability of alkenes:-**

(a). $H_2C=CH_2$ α-H = 0

(b).  αH = 3

(c).  αH = 6

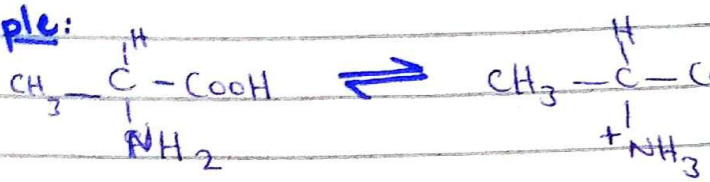
(d).  αH = 9

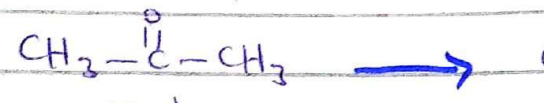
(e).  αH = 12

(ii) 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.

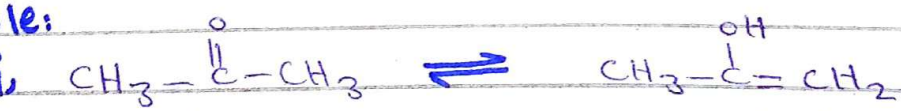
⇒. Tautomerism has no effect on bond length or such feature.

⇒. 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:**

(i) 

(ii) 

(2) **Prototophy:-** The type of tautomerism arise due to only trasfer of Proton within a molecule such as amino acid is called Prototophy.

⇒ **Annular Tautomerism:-**

The type of tautomerism arise due shifting of e^- 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.

$CH_3-CH=NH \rightleftharpoons CH_2=CH-NH_2$

Imine