14.8.20

B.Sc. Part I (Hons.)
Organic chemistry.

Inductive Effect :—

→ Partial shifting of σ e⁻ towards more E.N. atom of σ-bond.

→ Partial charges are developed.

$\overset{\delta\delta\delta^+}{C} \rightarrow \overset{\delta\delta^+}{C} \rightarrow \overset{\delta^+}{C} \rightarrow\rightarrow\rightarrow \overset{\delta^-}{X}$ [E.N. of X > E.N. of C

↳ Electron withdrawing group.

(−I group)

$\overset{\delta\delta\delta^-}{C} \leftarrow \overset{\delta\delta^-}{C} \leftarrow \overset{\delta^-}{C} \leftarrow\leftarrow\leftarrow \overset{\delta+}{Y}$

↳ Electron donating group

[+I group]

Resonance Structures :—

→ Shifting of π e^- / lone pair within the compound.

→ Resonating structures are hypothetical and intramolecular phenomenon.

→ Combination of resonating structure are hybrid structure.

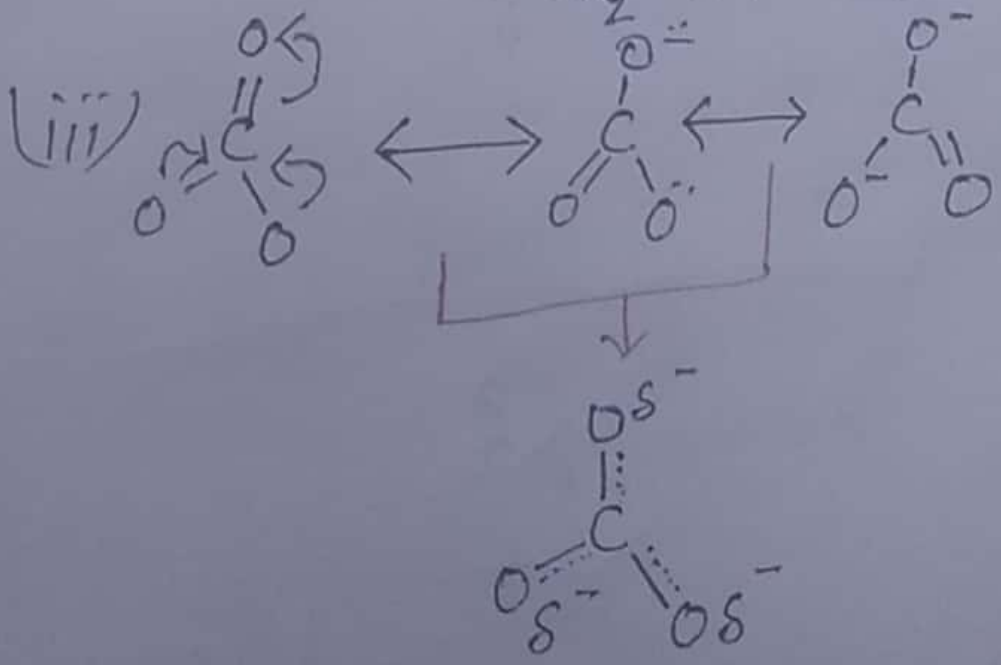
(i) $CH_2=CH-\overset{+}{C}H_2 \longleftrightarrow CH_2-\overset{+}{C}=CH_2$

$\delta+ \quad \delta+$
$CH_2 \cdots CH \cdots CH_2$

(ii) $\overset{-}{C}H_2=CH-\overset{-}{C}H_2 \longleftrightarrow CH_2-CH=\overset{-}{C}H_2$

$\delta- \quad \delta-$
$CH_2 \cdots CH \cdots CH_2$

(iii)



Conditions for Resonance :

(1) Conjugation :-

$\pi \rightarrow \sigma \rightarrow \oplus$

$\pi \rightarrow \sigma \rightarrow$ Lone pair.

$\pi \rightarrow \sigma \rightarrow$ •

$\pi \rightarrow \sigma \rightarrow \pi$

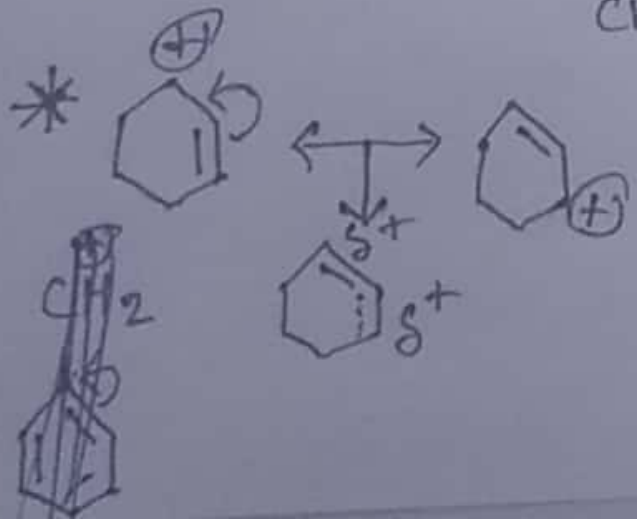
l.p. $\rightarrow \sigma \rightarrow \oplus$

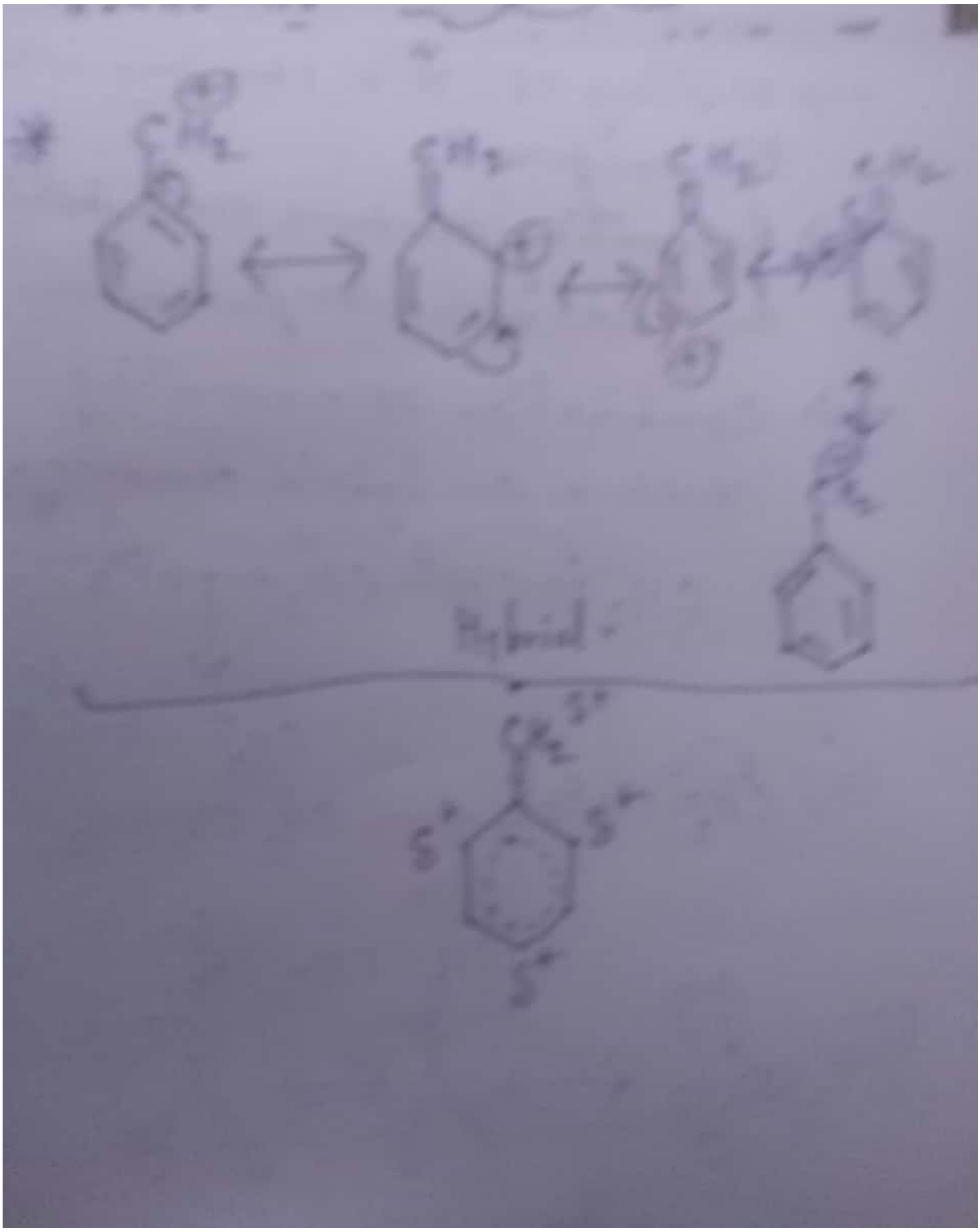
Conjugate position :

(1) $\pi \rightarrow \sigma = \oplus$

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

$\overset{\delta+}{C}H_2 \cdots CH \cdots \overset{\delta+}{C}H_2$



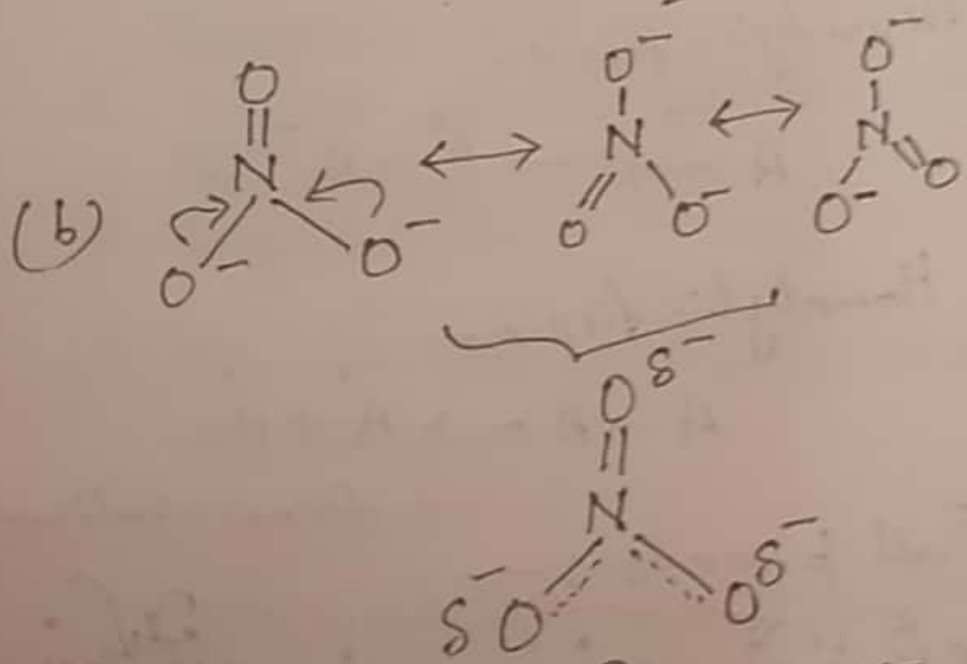


(5)

II. $\pi \rightarrow \sigma$ – Lop I(–)

(a) $CH_2=CH-CH_2^- \leftrightarrow {}^-CH_2-CH=CH_2$

$CH_2=CH=CH_2^{\delta-}$

(b) 

(c) $CH_2=CH-\ddot{N}H_2 \leftrightarrow {}^-CH_2-CH=\overset{+}{N}H_2$

$CH_2=CH=NH_2$ ($\delta-$ on CH_2, $\delta+$ on NH_2)

Notes: The total charge on all resonating structure must be equal
Position of Atom must not be changed.

(d) $CH_2=CH-\ddot{O}H \leftrightarrow {}^-CH_2-CH=\overset{+}{O}H$

$CH_2=CH=OH$ ($\delta-$ on CH_2, $\delta+$ on OH)

III. $\pi - \sigma - \bullet$ (free radical)

→ Heterolytic fission

$$A \overset{\curvearrowright}{-} B \rightarrow A^{+} + B^{-}$$

→ Homolytic fission

$$A - A \longrightarrow A^{\bullet} + A^{\bullet}$$

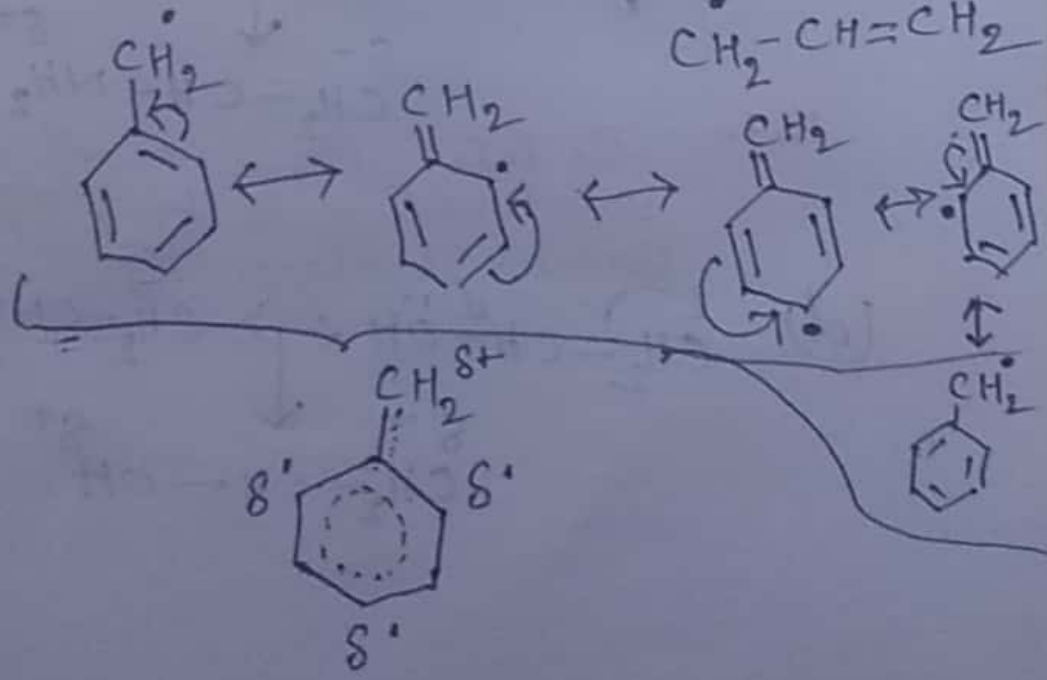
free radical.

Full process :—

→ homolytic fission

$$CH_2 = CH - CH_2 \longleftrightarrow CH_2 - CH - CH_2$$

$$CH_2 - CH = CH_2$$



Stability of Resonance structure —

→ Rules for stability

1. More no. of covalent bonds makes structures stable.
2. Neutral species are more stable than charged species.
3. Negative charge on more EN atom ⇒ more stability
4. Two like charge must be separated far for being stable.

Practice problems ; —

1. $CH_3-\ddot{O}-CH_2^{(+)} \longleftrightarrow CH_3-\overset{+}{O}=CH_2$

(a) (b)

→ (b) is more stable than (a) due to more no. of covalent bond (why ?)
Due to bond-formation, more energy will be release hence it is stable.

II $CH_2^{\leftarrow}=CH-\overset{\rightarrow}{\ddot{N}}H_2 \longleftrightarrow \overset{(-)}{CH_2}-CH=\overline{NH_2^{(+)}}$

(a) (b)

→ (b) is less stable than (a) because, neutral species are more stable than charged species.

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