Inductive Effect

Order of -I effect →

$-\overset{\oplus}{N}F_3 > -\overset{\oplus}{N}R_3 > -\overset{\oplus}{N}H_3 > -NO_2 > -C\equiv N$

$> -CHO > -\overset{O}{\overset{\|}{C}}- > -F > -Cl > -Br > -I$

$> -\overset{sp}{C}\equiv CH > -Ph > -CH=CH_2 > -H$

(Ph: sp^2; $-CH=CH_2$: sp^2)

$CH_3 \overset{\delta-}{-} \overset{\delta+}{Mg}Br$

Order of +I effect

$-\overset{\ominus}{O}R > -\overset{\ominus}{O} > -\overset{\ominus}{C}O_2 > -C(CH_3)_3 > -CH(CH_3)_2 > -CH_2-CH_3 > -CH_3 > -D > H$

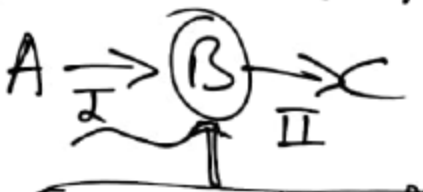
$-\overset{\oplus}{N}(CH_3)_3$

Inductive Effect

Application of Inductive Effect

A → B

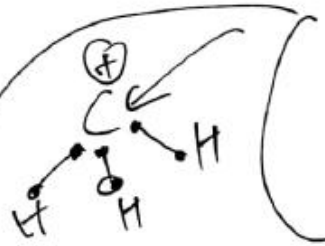
Stability of Intermediate



* carbocation/cation
* Carbanions
* F·R
* Carbene
* Nitrene

Inductive Effect

Carbocation (CH_3^+)



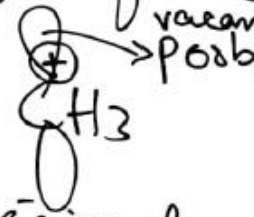
A = no of σ bond (3)

B = no of l.p (0)

A + B = 4 ⇒ sp^3

3 ⇒ sp^2

2 ⇒ sp

* sp^2 hybridised
* It is formed by heterolytic bond fission/cleavage
* 

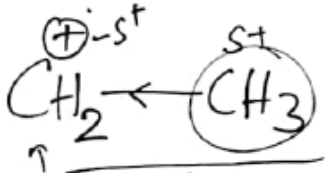
sp^2 $1s^2 2s^2 2p^2$
* 6 e^-s in valence shell
* e^- deficient.
* Carbocation Stability $\propto$ +I effect

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

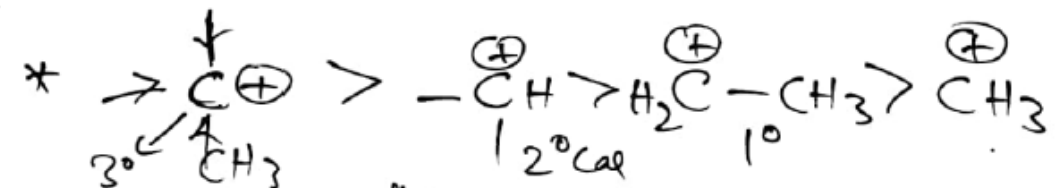
Heterolytic bond fission: $A-B \rightarrow A^+ + B^-$

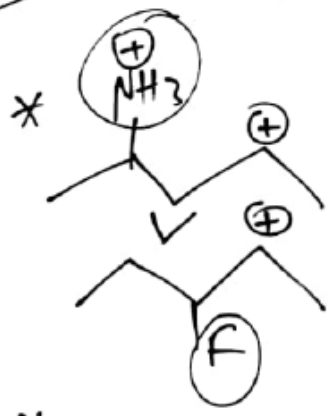
Homolytic bond fission → F.R: $A-B \rightarrow A^\cdot + B^\cdot$

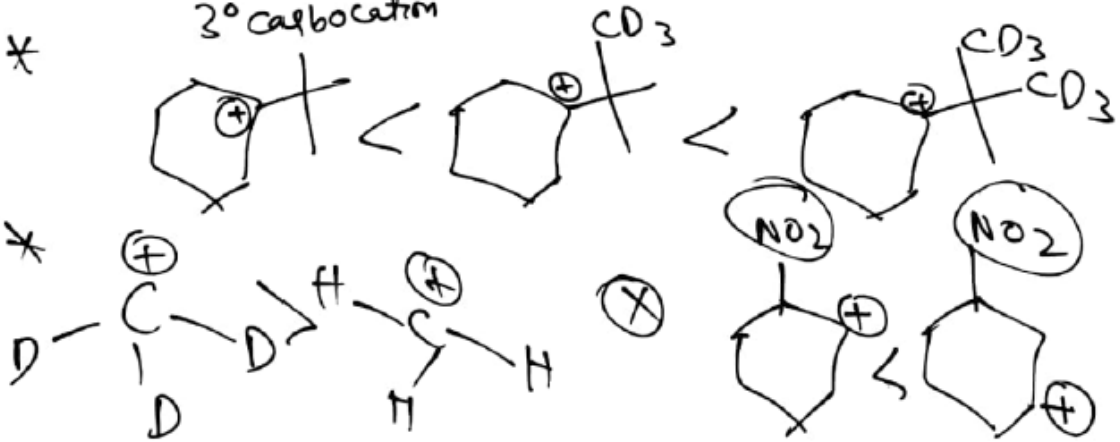
Inductive Effect



Q. Compare Stability





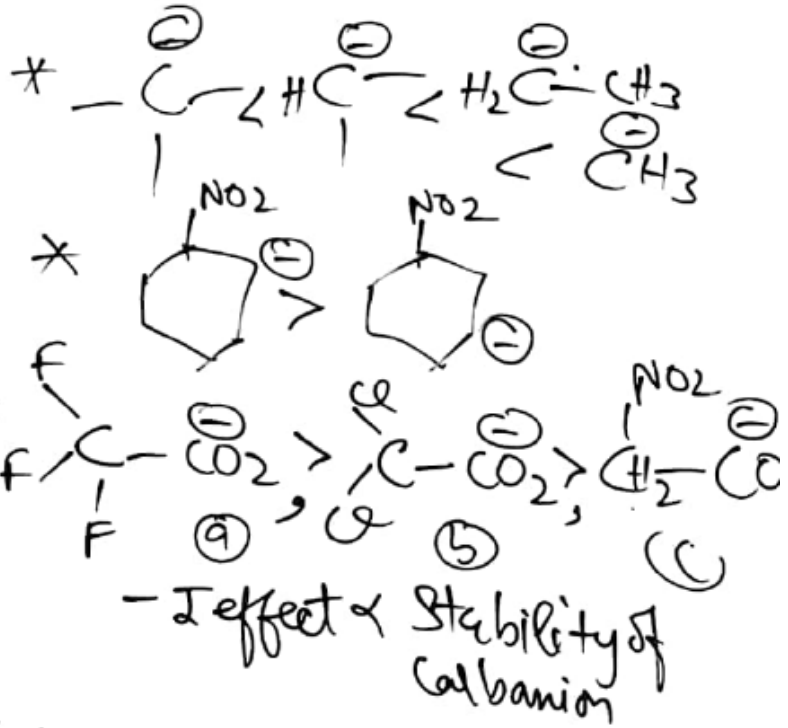


Inductive Effect

Carbanion

(CH_3^-)

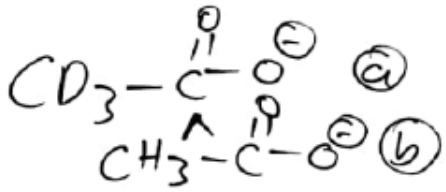
* heterolytic bond fission
* sp^3 hybridised
* 8 e^-s in valence shell
* e^- rich
* +I effect $\propto \frac{1}{\text{Stability of Carbanion}}$



-I effect $\propto$ Stability of Carbanion

Inductive Effect

E·R

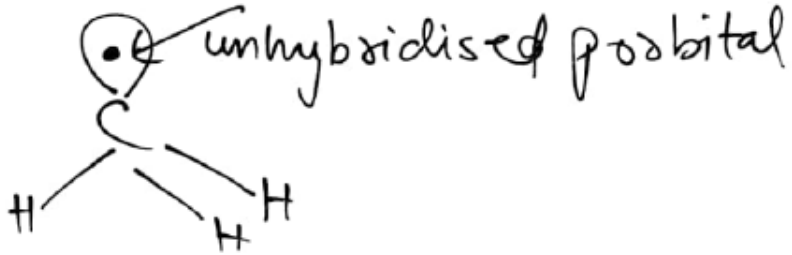


→ formed by homolytic bond fission

→ sp^2 hybridised

→ 7 e^-s in valence shell

→ e^- deficient



→ Stability same as carbocation

$3^0 > 2^0 > 1^0$