−I series

(*) Decreasing order of En/group En is known as −I series.

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

$> -F > -Cl > -Br > -I > -COOR > -^{n}R$

$> -OH > -NH_2 > -\overset{sp}{C}\equiv CH >$  $> -\overset{sp^2}{C}H=CH_2$

+Inductive effect :-

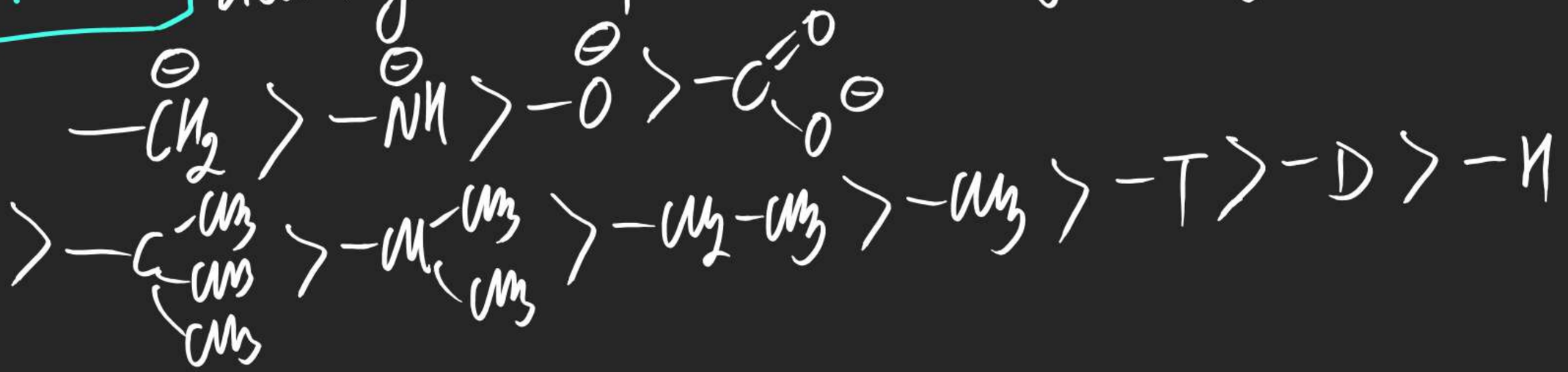
$\Rightarrow$ A/G which are electron donating are known as +I groups.

or

$\Rightarrow$ - - - - -

$$\gamma_{A/G} < \gamma_H$$

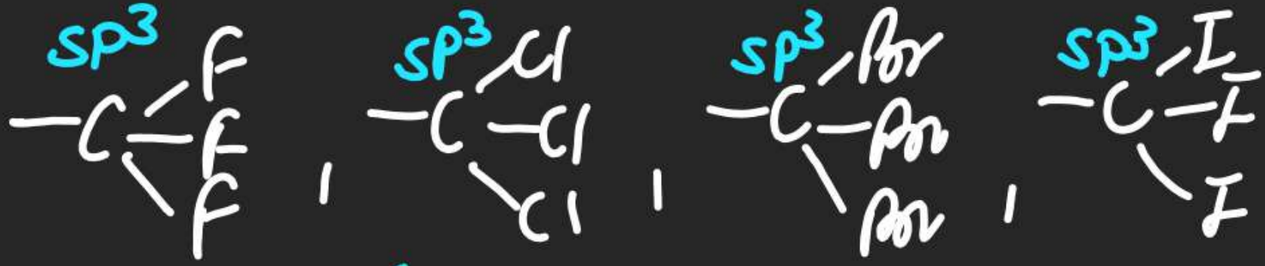
+I series decreasing order of Electron donating Tendency.



Ex: Arrange following in ↓ order of I effect

(i) $-F$, $-Cl$, $-Br$, $-I$ (−I effect)

(I > II > III > IV)

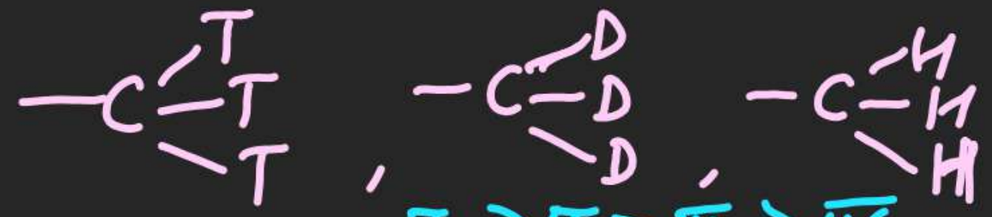
(ii) 

(−I effect)

(I > II > III > IV)

(iii) $-T$, $-D$, $-H$ (+I effect)

(I > II > III)

(iv)  (+I effect)

I > II > III > IV

(v) 

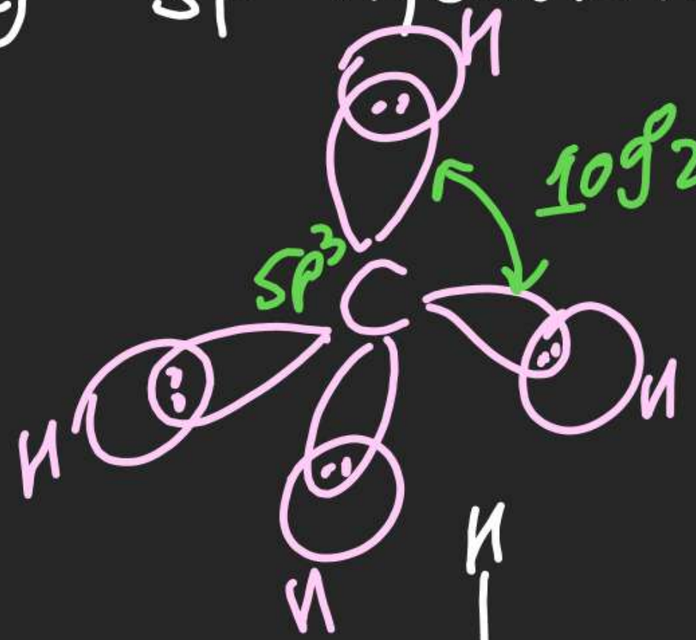
(I > II > III > IV)

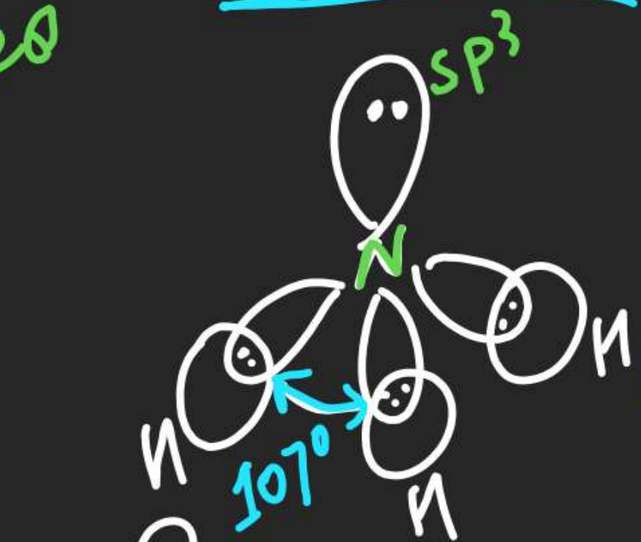
(vi) $-CH_2-CH_3$, $-CH_3$, $-H$ (+I effect)

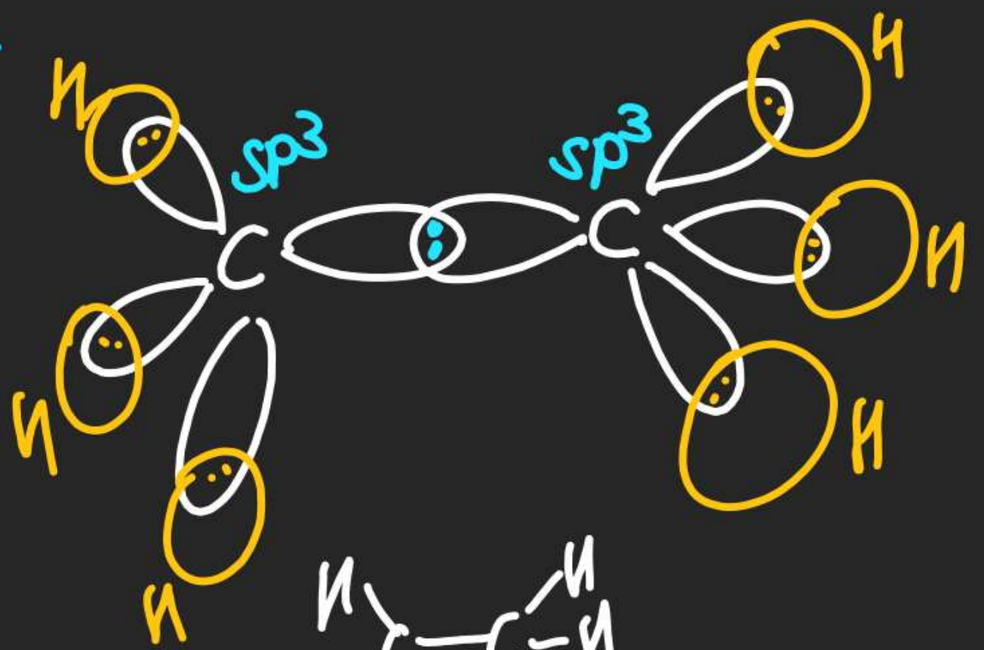
(vii) $-CH_2-CH_2-CH_3$, $-CH_2-CH_3$, $-CH_3$

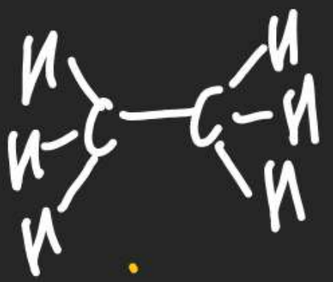
Ex :- Explain why I effect is applicable only on σ eg.

(#) sp^3 hybridisation ⇒ Atom must have 4 hybridised orbital
⇒ 4 σ Bond







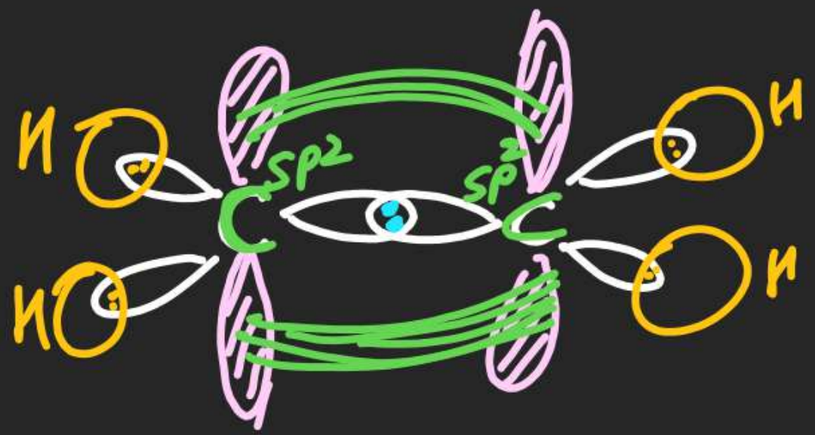


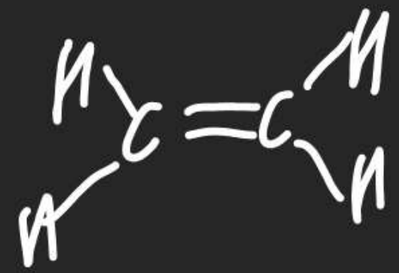
(#) sp^2 hybridisation

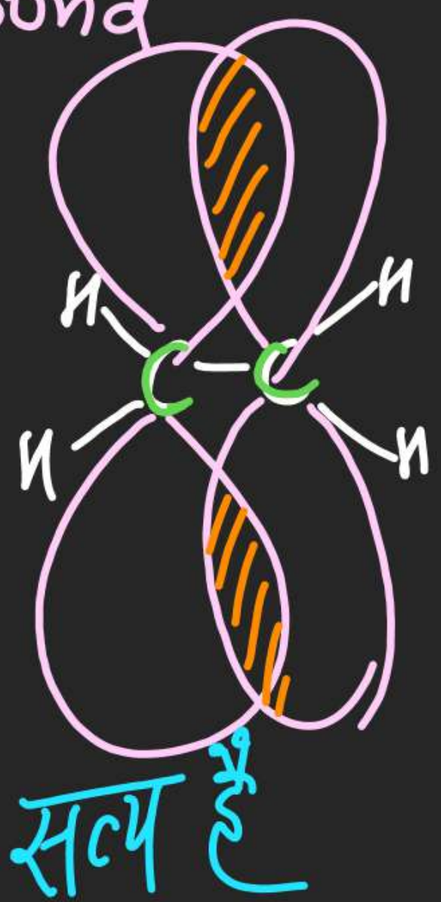
⇒ 3 hybrid sp^2 orbital & 1 unhybridised "p" orbital

⇒ 3σ Bond $+ 1\pi$ Bond

⇒ $B.A = 120^\circ$





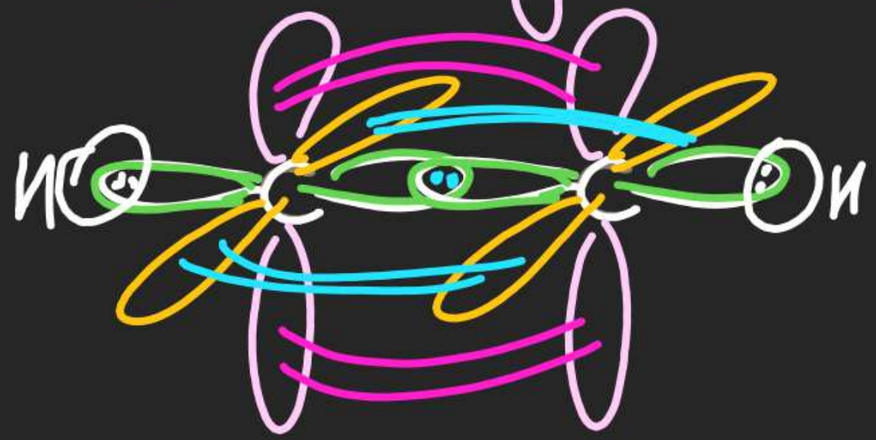


(#) SP hybridisation

$\Rightarrow$ 2 hybrid orbital + 2 unhybrid orbital (P_y, P_z)

$\Rightarrow$ ($2\sigma + 2\pi$) Bond

$\Rightarrow$ Bond Angle $= 180^\circ$



H—C≡C—H

For sp:

$\cos\alpha = -\frac{1}{c}$

SP $\Rightarrow \cos\alpha = -1$

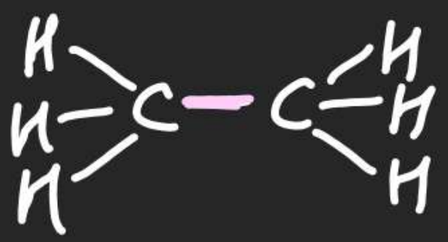
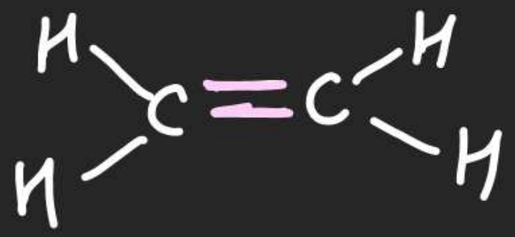
$\Rightarrow \alpha = 180^\circ$

$sp^2 \Rightarrow \cos\alpha = -\frac{1}{2}$

$\Rightarrow \alpha = 120^\circ$

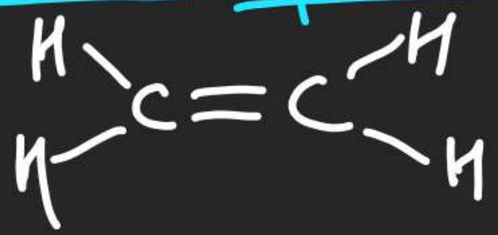
$sp^3 \Rightarrow \cos\alpha = -\frac{1}{3}$

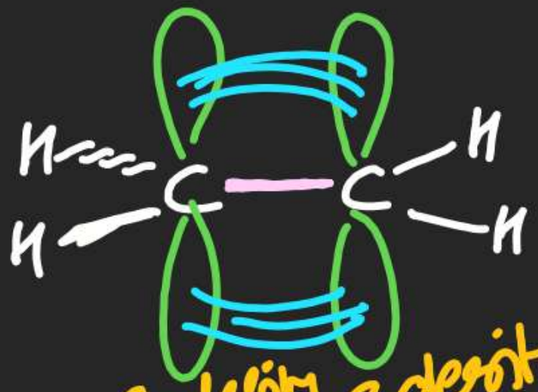
$\Rightarrow \alpha = 109^\circ 28'$

		BO(C–H)	BO(C–C)
(1)		1	1
(2)		1	2
(3)		1	3
(4)		$BO_{C-H} \in (0,1)$	$BO_{C-C} \in (1,2)$ or $BO_{C-C} \in (2,3)$

Orbital Diagram :-

(5)



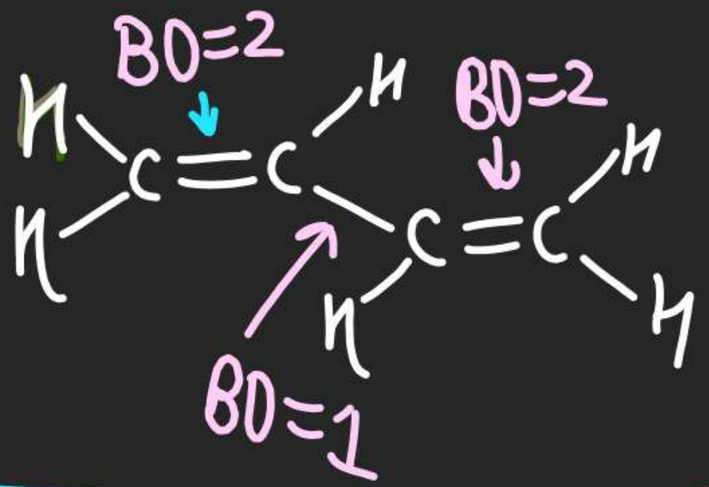


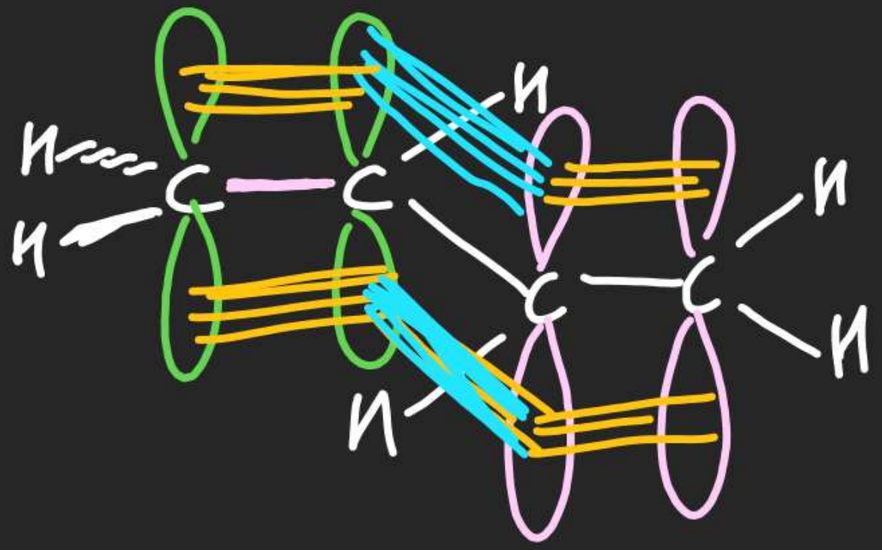
C delocalised e density

BO = 1 + 1

= 2

(6)



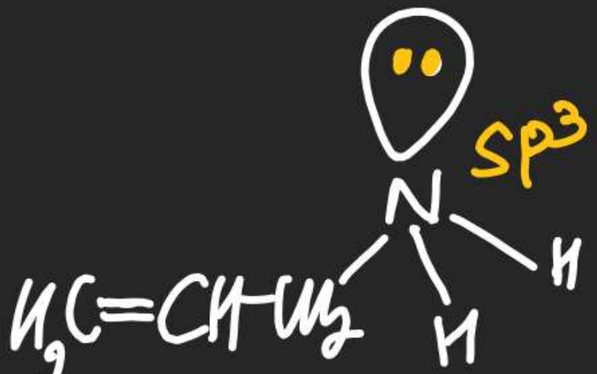


BO (C–C) ∈ (1, 2)

(7) $H_3C-CH_2-CH_2-NH_2$ (sp³ sp³ sp³ sp³)

localised lone pair

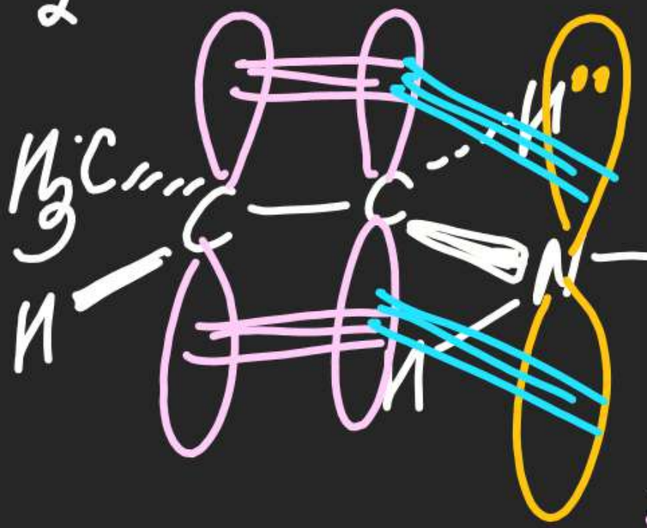
(8) $H_2C=CH-CH_2-NH_2$ (sp² sp² sp³ sp³)



localised lone pair

(9) $H_3C-CH=CH-NH_2$ (sp³ sp² sp² sp²)

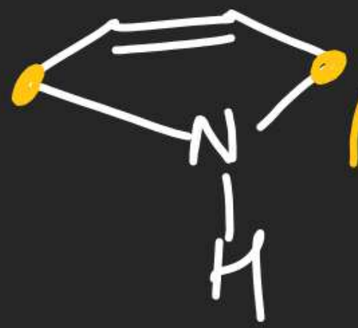
Simply Bonded



Delocalised lone pair

Note: If Singly Bonded lone pair atom contains "P" orbital on adjacent atom then that lone pair atom is "sp^2" hybridised & its one lone pair must be present in "p" orbital.

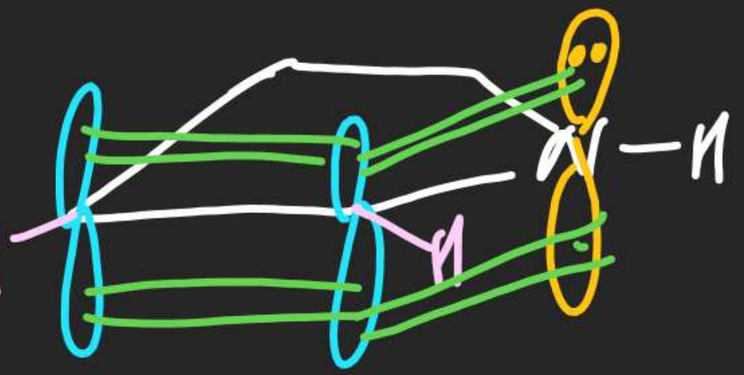
(10)



localised lone pair

(11)

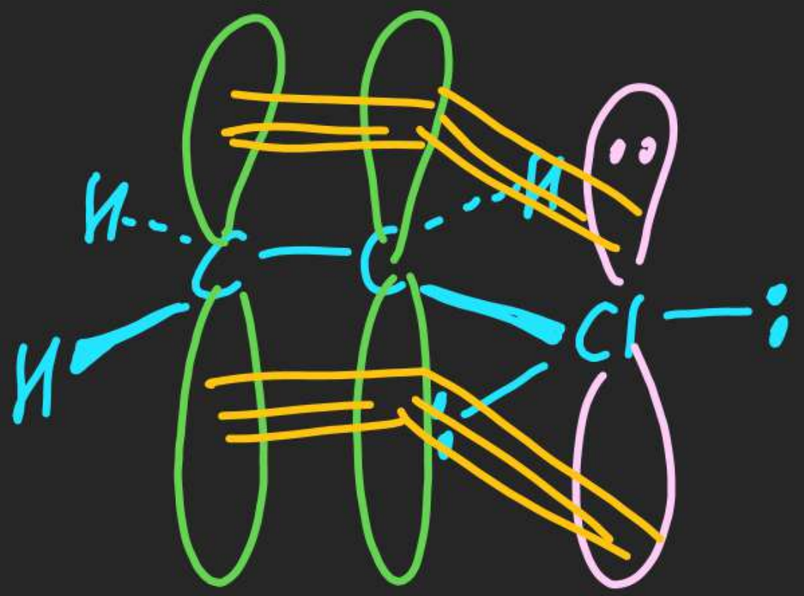
Delocalised lone pair



∴ ,

(12) (a) $CH_3-CH_2-Cl + NaOH \longrightarrow CH_3-CH_2-OH + NaCl$

(b) $CH_2=CH-Cl + NaOH \longrightarrow$ NO Rx^n



(13) 

(14) 

(15) 

(16) 

(17) 

(18) 

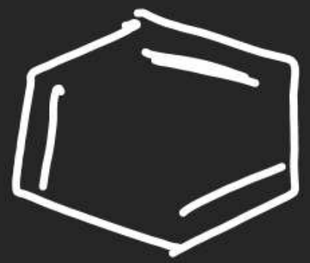
(19) 

(20) 

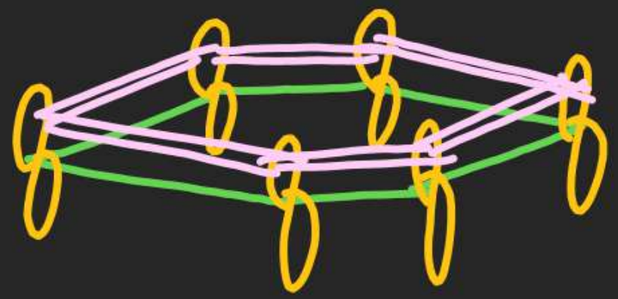
(21) 

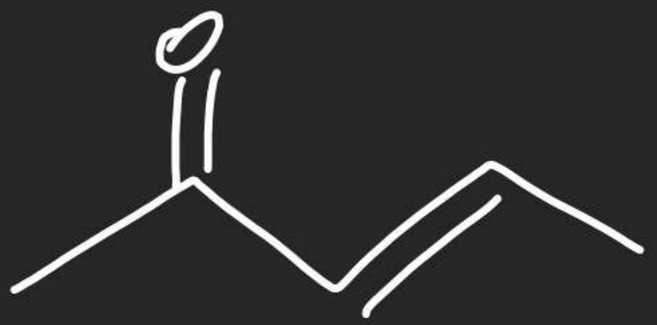
(22) $\overset{\oplus}{C}F_3$

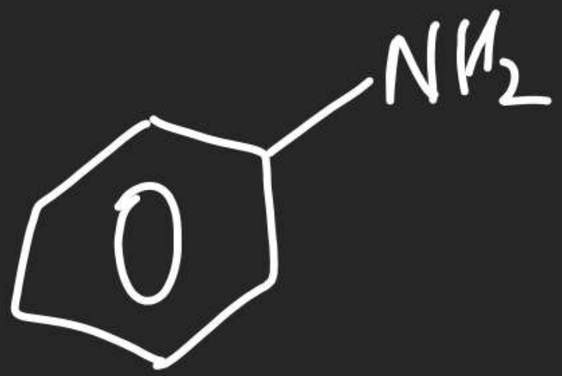
(23) $\overset{\ominus}{C}Cl_3$

(24) 

BO = 1.5



(25) 

(26) 

(27)

(28)