* non planer-
∠90 → 12

MOT →

Draw back of VBT →

It does not explain-

(i) Paramagnetic behaviour of O_2

liq O_2 → pale blue colour.

(ii) existance of odd electron species.

(iii) Fractional bond order.
(iv) ionisation energy of $O_2 < O$, $N_2 > N$
(v) B_2 & C_2 having only having π bonds.
(vi) CO BO = 3 , CO^+ · BO > 3
(vii) Colour of halogen

* Molecular Orbital theory →

(i) As electron in an atom present in ~~electron~~ atomic orbital e in molecule present in molecular orbital-

(ii) All atomic orbitals looses their

identity and form new molecular orbital in same number

eg → $O_2 \to 10$ [O → 1s 2s 2p
1 1 3 → 5
in one

$Li_2 \to$ Li → $1s^2\ 2s^1\ 2p^0$
⑤

$\boxed{Li_2 \to 10}$ Ans.

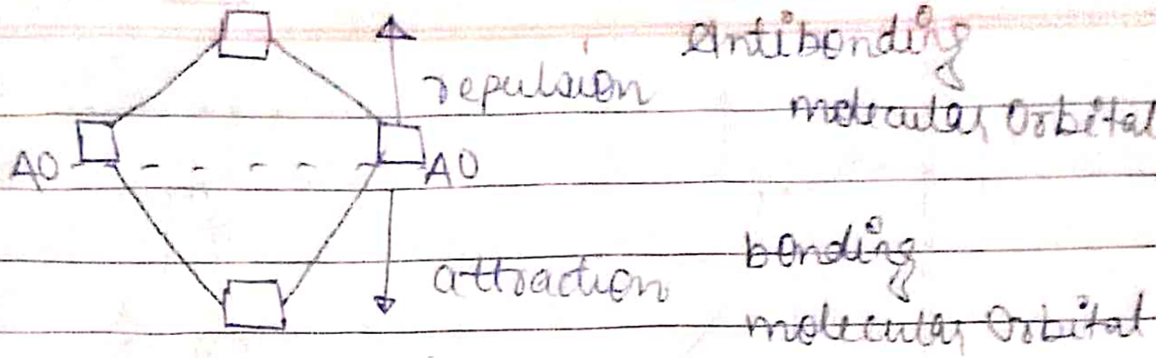
⇒ almost same energetic atomic orbitals participate in mixing.

⇒ Molecular orbitals can be differ in shape, size, orientation & energy depends on atomic orbitals which participate in bonding.

$1s + 2s \to$ ✗ | $2p_x + 2p_x$ ✓
$1s + 1s \to$ ✓ | $2p_x + 2p_y$ ✗

⇒ e^- are filled in these molecular orbitals by $(n+l)$ Hund's rule & pauli

⇒ Sum of energy of two AO = two MO



* Atomic orbitals are molecular orbital are polycentric (two nucleus or more than two

<u>linear combination of atomic orbitals</u> →

LACO <u>model</u>.

e^- → Dual nature

two atomic orbital →

AO ψ_A — AO ψ_B

$\psi_A + \psi_B$ ↓ $(\psi_A + \psi_B)^2$

$\psi_A^2 + \psi_B^2 + 2\psi_A\psi_B$

e density ↑

so bonding <u>MO</u>

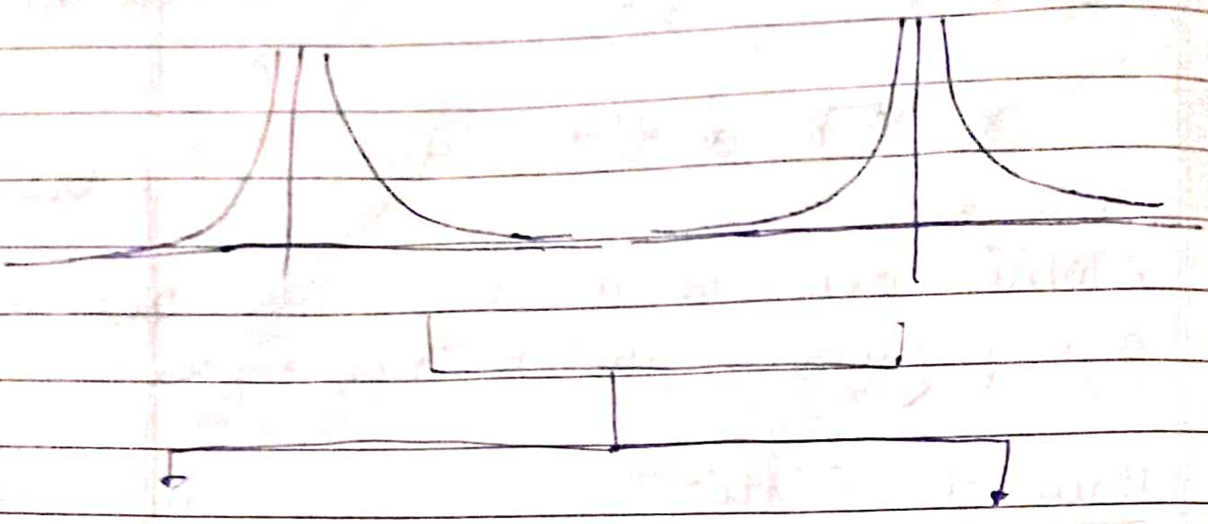
$(\psi_A - \psi_B)$ ↓ $(\psi_A + \psi_B)^2$

$\psi_A^2 + \psi_B^2 - 2\psi_A\psi_B$

e^- density ↓

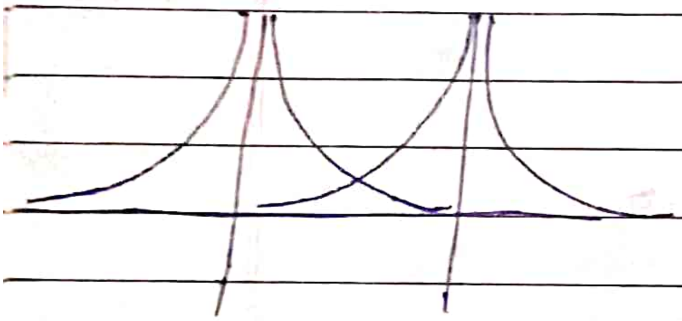
so antibonding MO.

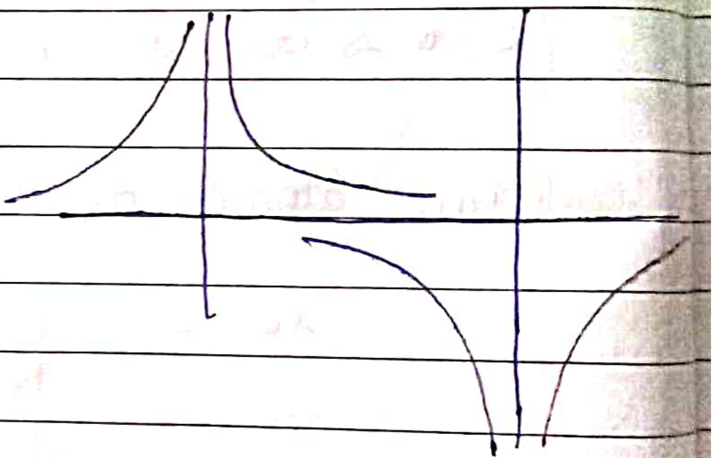
ψ_A (1s) ψ_B (1s)



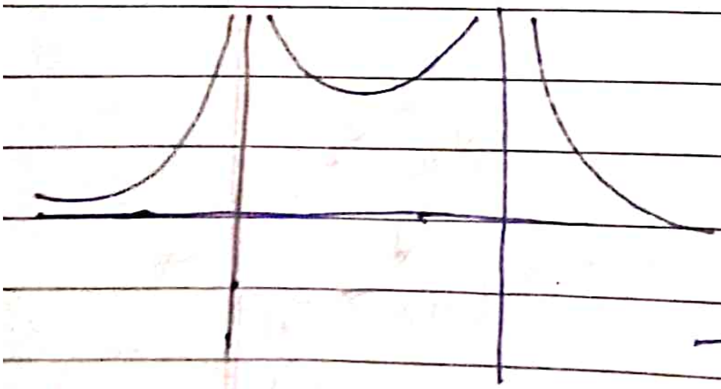
$\psi_A + \psi_B$ (constructive)

$(\psi_A - \psi_B)$ (destructive)

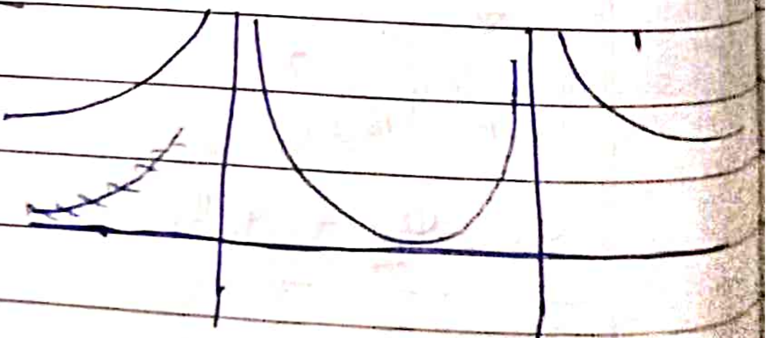




$(\psi_A + \psi_B)^2$



$(\psi_A + \psi_B)^2$



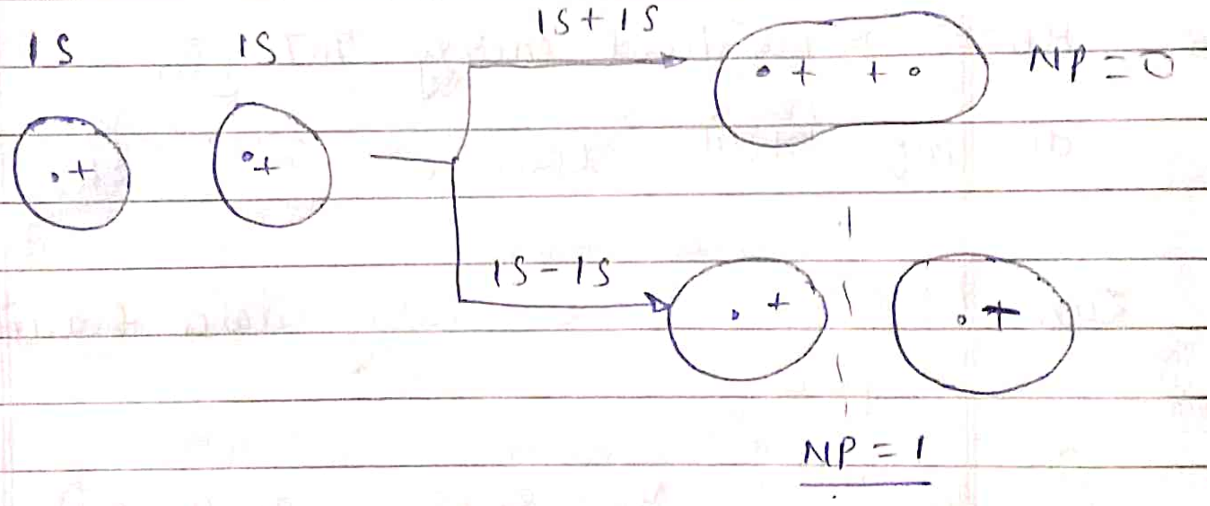
attraction

replusion

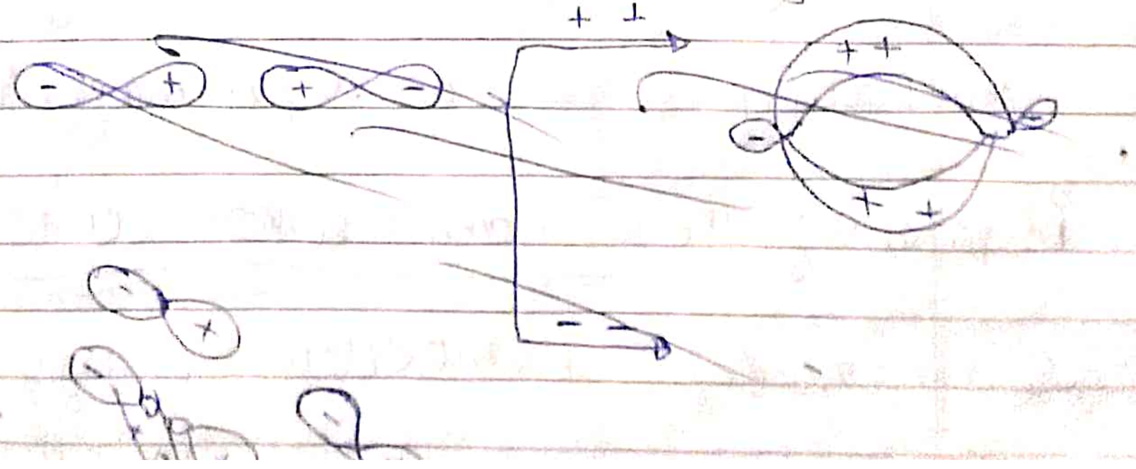
O_2 F_2 → e in p

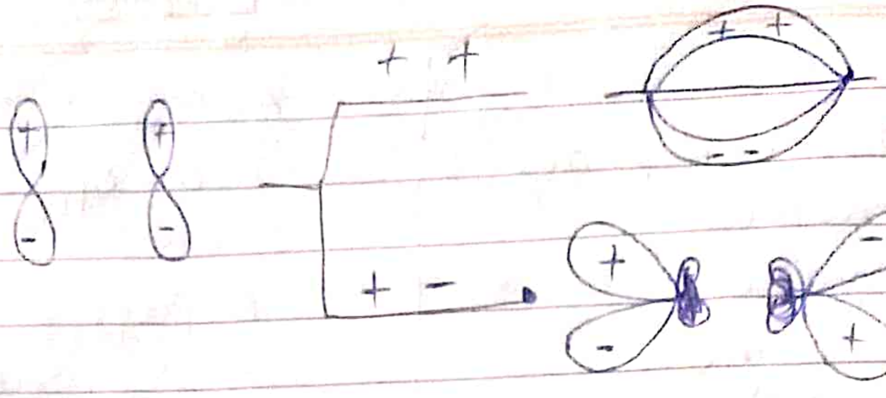
remaining → one

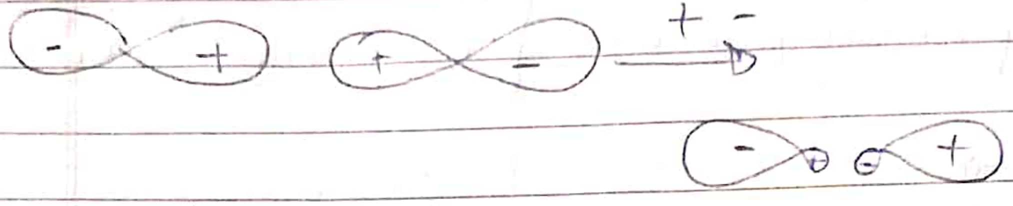
BMO	ABMO
→ AO in same phase	AO in opposite phase
→ Constructive	destructive
→ attraction	Repulsion
→ energy < AO	energy > AO
→ stability > AO	stability < AO
→ if nodal plane = x	then nodal plane x+1
name → σ, π, δ	name → σ*, π*, δ*



centre of symmetry about phase sign → gerade







HOMO → Highest energy भरा हुआ

वो MO जिसमे last e⁻ जाता है

LUMO → Lowest energy wala having space

वो MO जिसमे New electron enter करे

SOMO → singly occupied MO

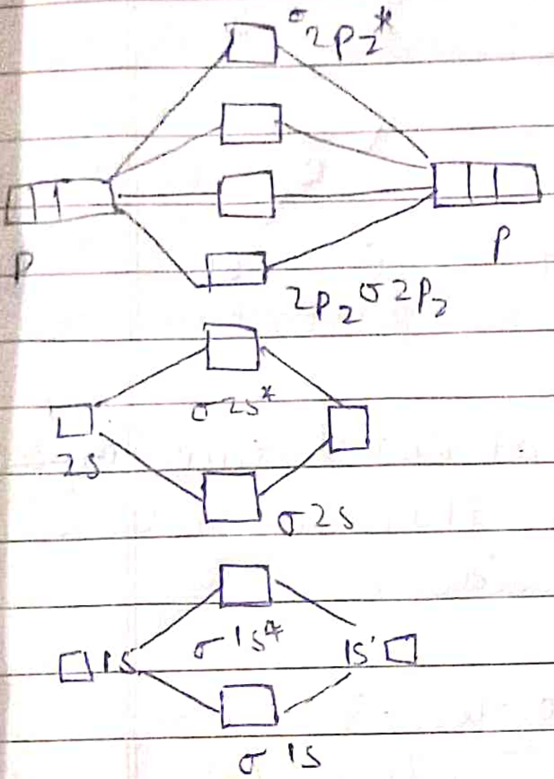
MO having single e⁻ → paramagnetic

in paramagnetic — HOMO = SOMO = LUMO

Diamagnetic — HOMO<LUMO energy

σ stronger than π

Energy diagram for O_2 F_2 N_2 & their charge species.



O_2 →

$\sigma^* 2p_z$	☐
π* π*	↑ | ↑
π − π	↑↓ | ↑↓
σ $2p_z$	↑↓
σ* 2s	↑↓
σ 2s	↑↓
σ* 1s	↑↓
σ 1s	↑↓

O_2 → paramagnetic.

HOMO = LUMO = SOMO = π*

---

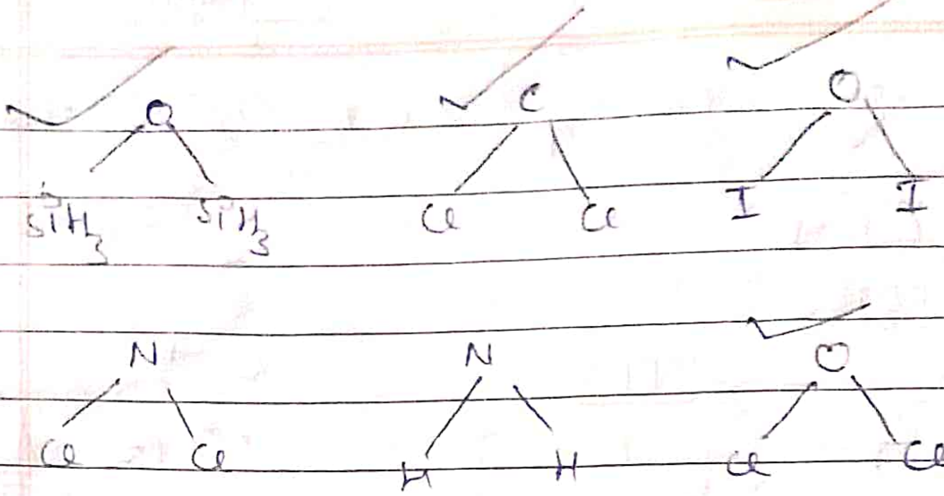
case two → when type is same & SN → same

→ molecule → see molecule have/has drago's rule

→ steric hinderance (steric hinderance repulsi

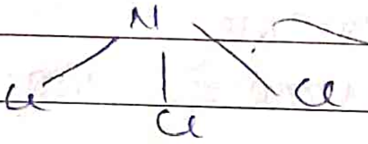
loan pair - loan pair repulsion)

→ when C & O having at least two large group/atom like → Cl|Br|I|R|silane group.



→ in case of 'N' → at least two ~~[illegible]~~ Cl/Br/I is present then no steric hinderance is considers.

Reason → $N_2 + Cl_2(\text{excess}) \xrightarrow{\Delta} NCl_3$
$(\Delta H = +ive)$



→ bond length is बहुत बड़ा

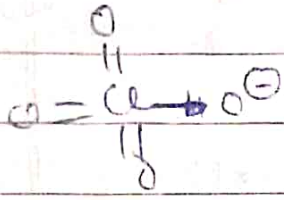
among all trihalide of N only NF_3 is stable.

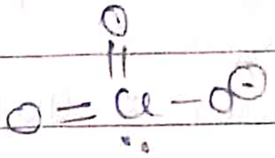
* When 'N' is central atom at least two R/silane creates steric hindu-ance

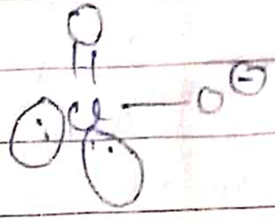
~~Note → NH_3~~

(iii) Bond order ∝ bond angle

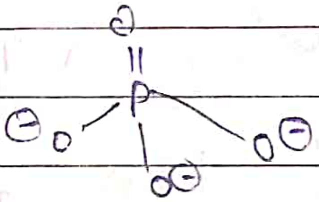
$ClO_4^- > ClO_3^- > ClO_2^-$

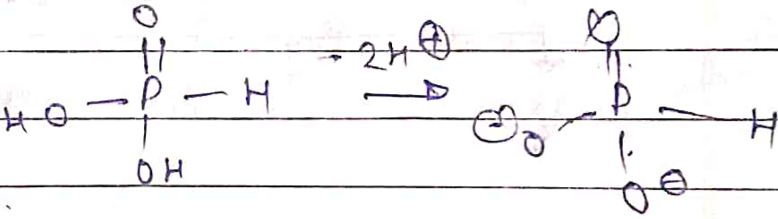

(i)

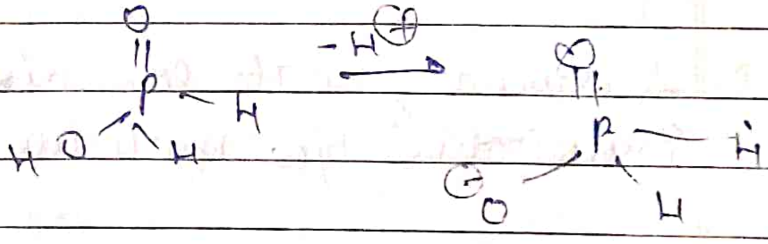

(ii)


(iii)

B = 1.75   1.66   1.5

⇒ H_3PO_4 ⇒  $+3H^+$ $\frac{5}{4}$ BO→

H_3PO_3 ⇒  $\frac{4}{3}$ BO→

H_3PO_2 →  $\frac{3}{2}$ BO→

Hence →

angle ∝

$H_3PO_4 < H_3PO_3 < H_3PO_2$

θ

in drago the angle ≃ 90

[illegible]

(IV) surrounding w.r.t. central is sam

$CH_4 = CF_4 = CCl_4 = CBr_4 = CI_4$
$BCl_4 = BeCl_2 = GeH_4 = SnH_4$
$SiF_4 = SiCl_4$
$AlCl_3 = AlBr_3 = AlI_3$

Drago's rule → CA → 3d block
SN = 4
$\boxed{\chi \le 2.5}$ of surrounding atom

bond parameter → Type same
bond parameter → Type is differ → Drago's, Stearic, Bond order

(V) → Surrounding w.r.t. CA = different and investigation b/w molecule different.

* $H_2O > H_2S$
bond angle
drago

$\ddot{N}H_3$ $\ddot{N}F_3$

α $S > Cl$

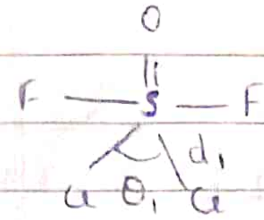
$PF_3 > PH_3$ drago's rule

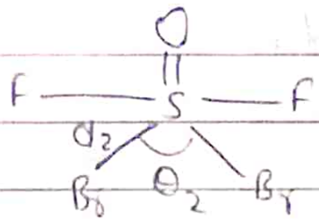
$OCl_2 > H_2O > OF_2$

steric hinderance.

$SF_2 > H_2S$ drago's rule

in trigonal bipyramidal more electronegative atom is at axial position.





$\boxed{\theta_2 > \theta_1}$ Q.

$\boxed{d_1 < d_2}$ Q. { I^{st} mind on shell and the electronegativity)

Bent's rule →

Type same

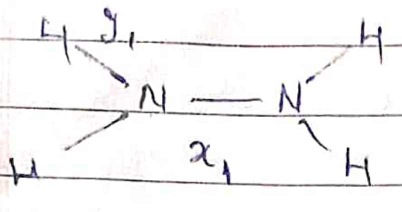
Eg BO = same

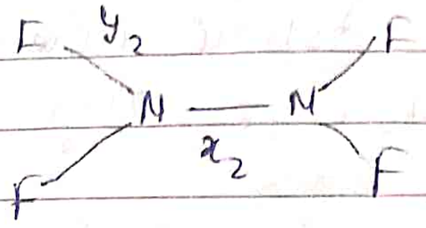
surround wrt CA = differ. but investigation is same.

Bent's rule suggest more electronegative atoms or group occupies more %p / less s% character.

for finding bond length if shell no is same then only use E.N factor.

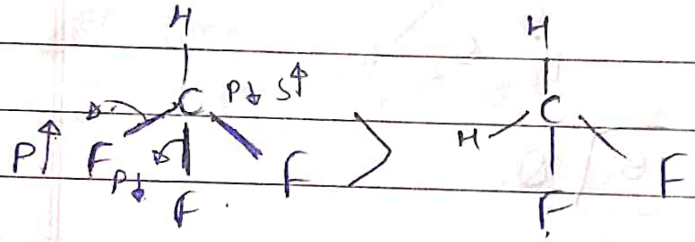
** %p ↑ bond length more





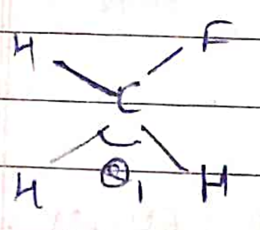
$x_1 > x_2$

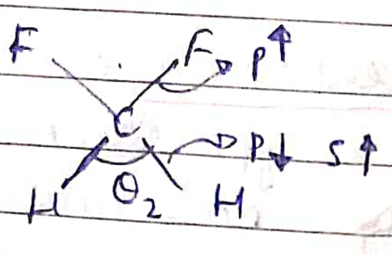
$y_2 > y_1$



→ Bents rule

3B! ∠CFC 50%



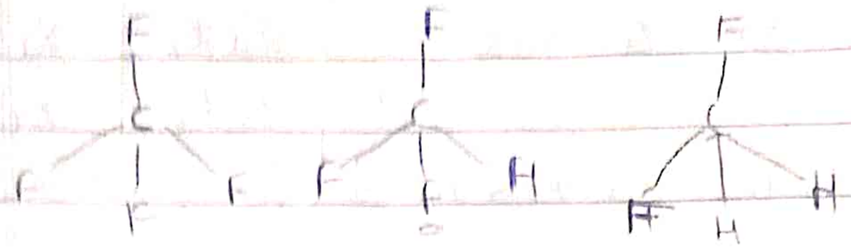


$\boxed{\theta_2 > \theta_1}$ ⊗

⊗

H = 2.1

Date 12 10 2020



r → 4p 3p 2p

25% 33.33 50%

$\theta_1 > \theta_2 > \theta_3$

Q → Species like PCl_5, PF_5 exist. but not PH_5.
" " SF_6 exist but not SH_6
" " XeF_4 exist but not XeH_6
" " SF_4 exist but not SH_4

d orbital contraction
because due to F bonded with S which creat δ+ charge on S atom due to which d orbital contraction happen so.

repulsion dominant → stearic hinderance

$SX_6 = (x = Cl \mid Br \mid I)$
$SiX_6^{2-} = (x = \text{'' ''})$
$PX_6^- = (Br \mid I)$
$BrX_4^- = (Cl^-, Br^-, I^-)$

→ loan pair - repulsion
→ (XeF_3^-) does not exist
→ +ive charge generate which lower the energy and creat attraction

density ↑ decreas.

$XeO \rightarrow Xe + O$

	X
XeF_2	XeO
XeF_4	XeO_2

$XeF_2 + H_2O \rightarrow Xe + HF + O_2$

$(XeO \rightarrow Xe + O_2)$

dipole moment →

Dipole moment is a quantative measurement of to know the extent of polarity

→ It is defined as product of charge and distance b/w them. It is a vector quantity and direction is from +ive to -ive.

μ = charge × d

unit = coulamb - meter
esu - c - m
(c.g.s)

Debye (unit).

1D → 10^{-18} esu - cm
= 3.3×10^{-30} coulamb - meter

Note → in dipole moment charge dominent over distance. except (C-Cl) (distance dominant).

dipole moment order →

relate dipolemom with polarity

$H-F > H-Cl > H-Br > H-I$

② $O-H > S-H > Se-H$

③ $C-Cl > C-F > C-Br > C-I$

↓ distance dominant.

④ $CH_3-Cl > CH_3-F > CH_3-Br > CH_3-I$

→ if more than one dipole moment is present in molecule.

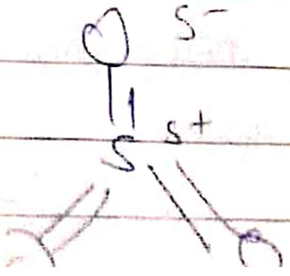
$$\mu_r = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2\cos\theta}.$$

✓ Case No 1 → when surrounding are same w.r.t. central Atom or symmetric

CO_2 → $O=C=O$ d → 0

→ Bonds are polar and molecule is non-polar.

2 → SO_3



$CCl_4 \rightarrow \mu = 0$

$PCl_3F_2 \Rightarrow 0$

$IF_7 = 0$ pentagon $\mu = 0$

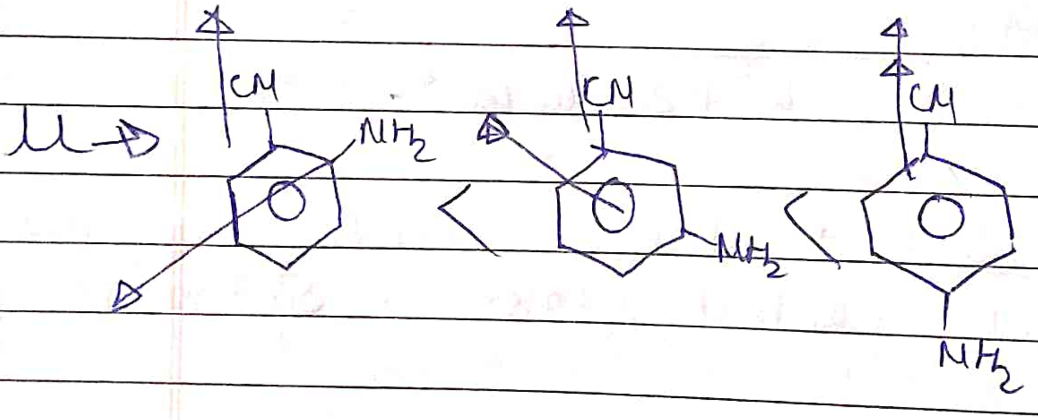
$XeF_4 = 0$ ✓

Q select ~~corr~~ correct option in terms of μ - molecule

(A) SF_4 ($\mu \neq 0$) (c) XeO_3 ($\mu \neq 0$)

(B) $(SiF_6)^{2-}$ (d) NH_3 (E) NF_3

$\mu \neq 0$ $\mu \neq 0$ $\mu \neq 0$



Application of dipole moment →

$$\% \text{ of ionic character} = \frac{\mu_{exp}}{\mu_{theoretical}} \times 100$$

Q % of Ionic character in HCl molecule having bond length of 1.02 A° and observed dipole moment is 1.27 D.

μ theoretical = $1.6\times10^{-19} \times 1.02\times10^{-10}$

$\Rightarrow 1.632\times10^{-29}$ //

$$\frac{1.27\times3.3\times10^{-30}}{1.632\times10^{-29}}\times100$$

$$\Rightarrow \frac{1.27\times33}{1.632} \Rightarrow 25.68\%$$

* (CO)

$\underline{\mu_{\text{ther}} > \mu_{\text{obs}}}$.

$\underset{+\quad -}{C\equiv O}$ theoretical

$\underset{+\quad -}{\overset{\leftarrow}{C\equiv O}}$ observed.

$\overset{\delta- \;\leftarrow\; \delta+}{\underset{+\quad\quad -}{C = O}} \Rightarrow \overset{+}{C}\equiv\overset{-}{O}$

→ gerade are defined for homonuclear & symmetrical

trick → nodal plane → even

ungerade → nodal plane → odd

$\frac{\text{no of proton}}{\text{no of } e^-} \propto IE \uparrow$ ✓

$X_2 \xrightarrow{-e^{\ominus}} X_2^{\oplus}$

BO n $\underline{n+0.5}$ → oxidation

$X_2 + e^- \longrightarrow X_2^-$

BO n $n+0.5$ reduction

Q

$\boxed{KO_2 \ \& \ O_2(BF_4)}$

Molecular energy level for hetero-nuclear species →

like - CO | NO | NO+ | CO+ | HF | NH_3^+ etc

→ every heteronuclear species undergo s-p mixing irrespective of no of protons. (H-F) NO

s-p mixing s-p mixing

→ have unique molecular energy level

Some parameter of Heteronuclear species like NO can be predicted using generation of Homonuclear.

NO → will follow sp mixing.

IE → $N > O > NO$

$NO_2^+ > NO^+ > N > O > NO > NO^- > NO_2^-$

NO undergo oxidation

Colour in Halogen due to Homo - Lumo electronic transition →

F_2 →

Colour in any compound arises due to →

① Excitation of e^-

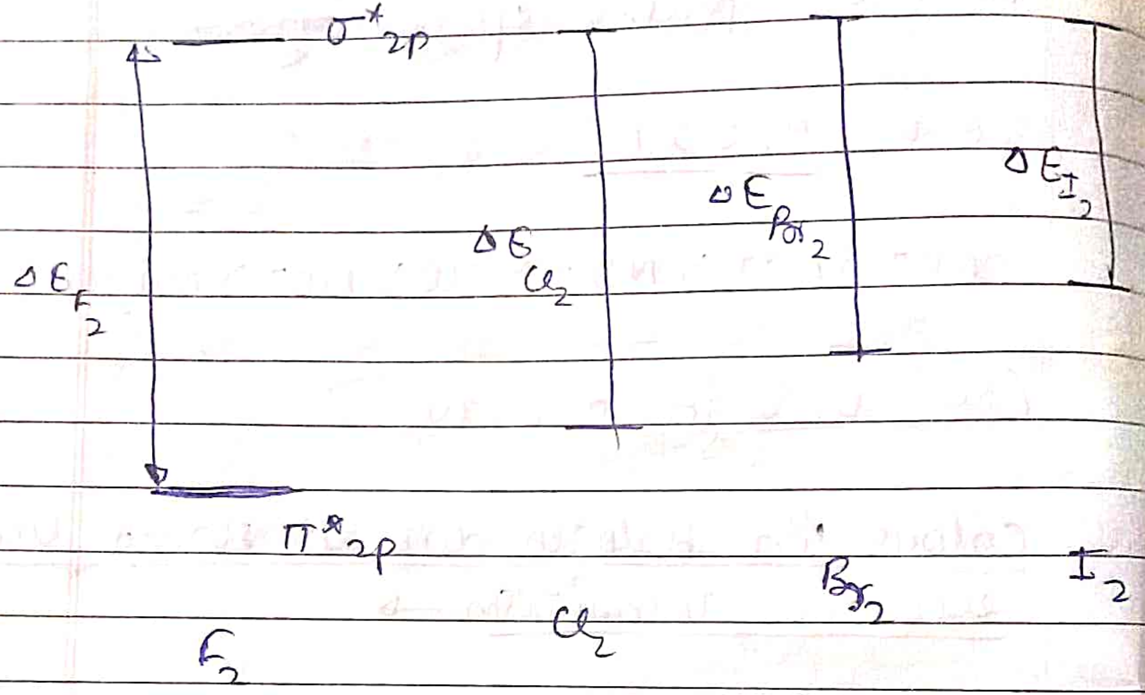
② Emission in visible region

in F_2 → excitation of e^- is from Homo (π^*2p) to Lumo (σ^*2p)

exication of e- is from Homo (π^*_{2p}) to LUMO (σ^*2p)

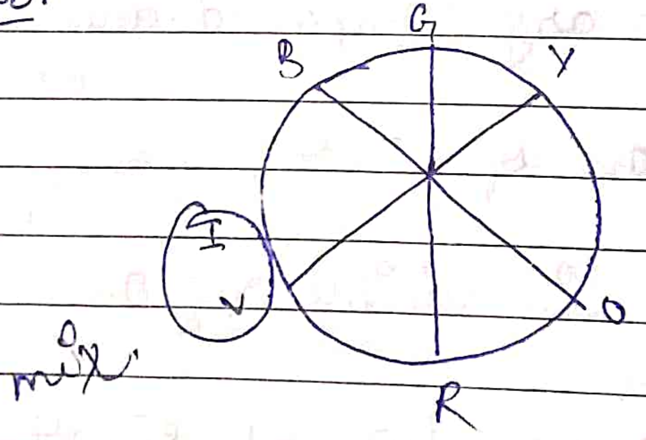
$Cl_2 \rightarrow \pi^*_{3p} \rightarrow \sigma^*_{3p}$

$Br_2 \rightarrow \pi^*_{4p} \rightarrow \sigma^*_{4p}$



$\Delta E = F_2 > Cl_2 > Br_2 > I_2$ $\quad \lambda_{ab} = I_2 > Br_2 > Cl_2 > I$

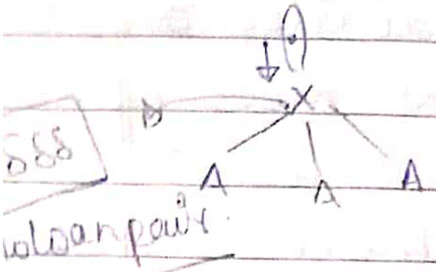
abT $\quad\quad$ Y G --- V



emitted is complimentry of absorb

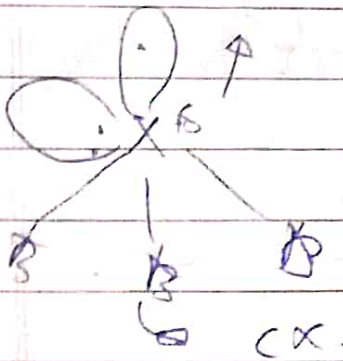
repulsion b/w 2e⁻ 2e⁻
single bond - single bond > single bond - odd electron
2e⁻ 1e⁻

Hybridisation of odd e⁻ species →



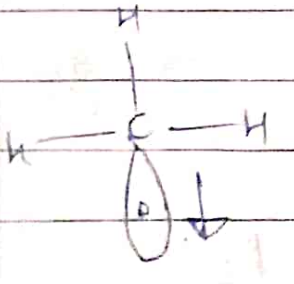
if X more EN then odd e⁻ will become more direction and will ~~hybid~~ hybridise.

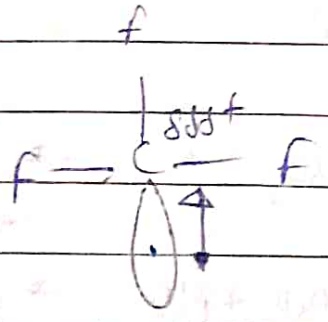
if central atom with ~~odd~~ +ve & with loan pair will not hybridise.



→(repulsion) will not participate in hybridisation

(X is more EN too) but loan pair.





sp^2 sp^3 $> 109^{\circ}28'$

~ 120

odd e⁻ species are para magnetic

hybridisation mean have directional property

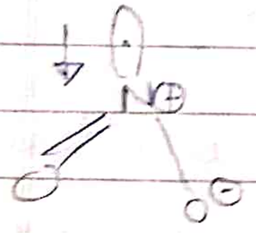
(I) $\dot{C}H_3 + \dot{C}H_3 \rightarrow C_2H_6$ ✓ K_1

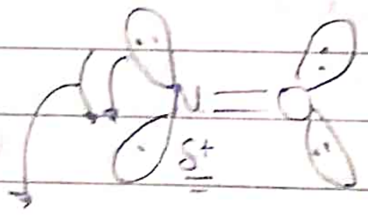
(II) $\dot{C}F_3 + \dot{C}F_3 \rightarrow C_2F_6$ ✓ K_2

$K_2 > K_1$

because in (II) have directional property so will have more K_2

~~at~~ temp → (I) need more temp as compare to II for dimerisation





repulsion SP

SP^2 ✓

BA > 120°

$NO_2 + NO_2 \rightarrow N_2O_4$ K_1

$NO_2 + NO \rightarrow N_2O_3$ K_2

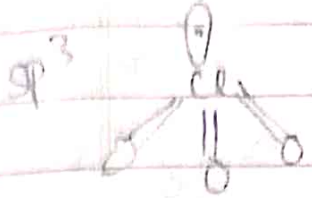
$NO + NO \rightarrow N_2O_2$ K_3

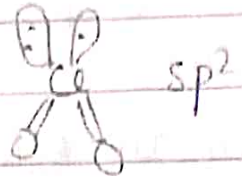
$K_1 > K_2 > K_3$

$ClO_3 + ClO_3 \rightarrow Cl_2O_6$

$ClO_2 + ClO_2 \rightarrow Cl_2O_4$

+ive charge loan pair → no hybridisation





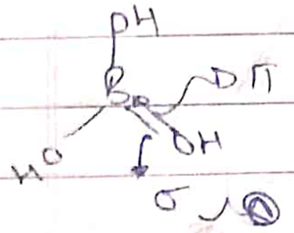
$\boxed{BA > 109^\circ 28'}$

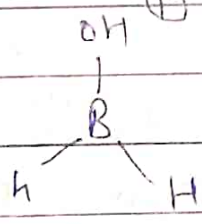
BA < 120

117° (loan pair)

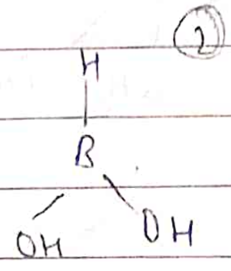
Application of Back bonding →

① Bond length due to B-B always decreases and B.E. due to B-B (back bonding) ↑

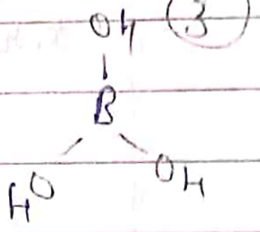




2



$\frac{3}{2}$



4/3

(B-O) bond energy ↓ 1 > 2 > III

BF_3	BHF_2	BFH_2
①	②	③
$\frac{4}{3}$	$\frac{3}{2}$	2

$\boxed{III > 2 > 1}$

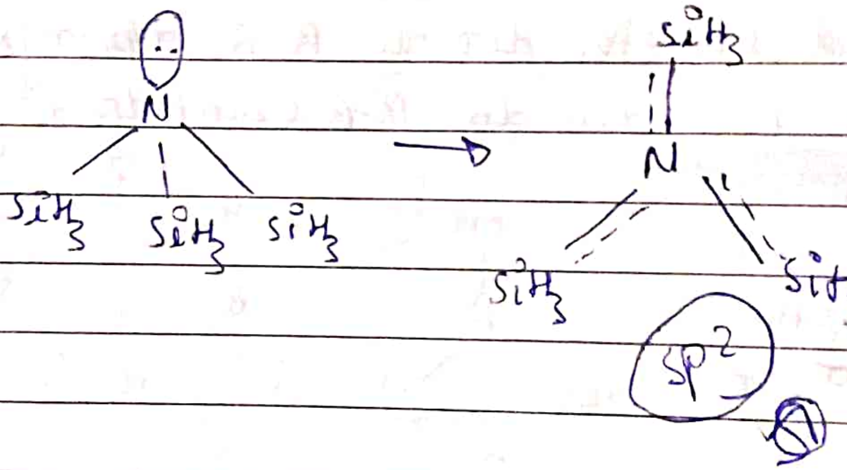
$BF_3 < BF_4^-$

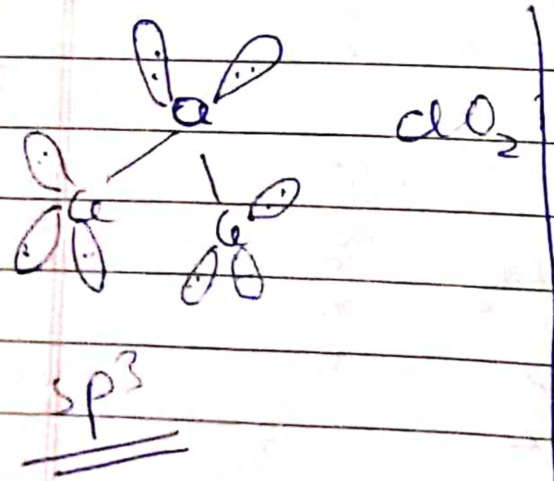
bond length → $BF_3 < BF_4^-$

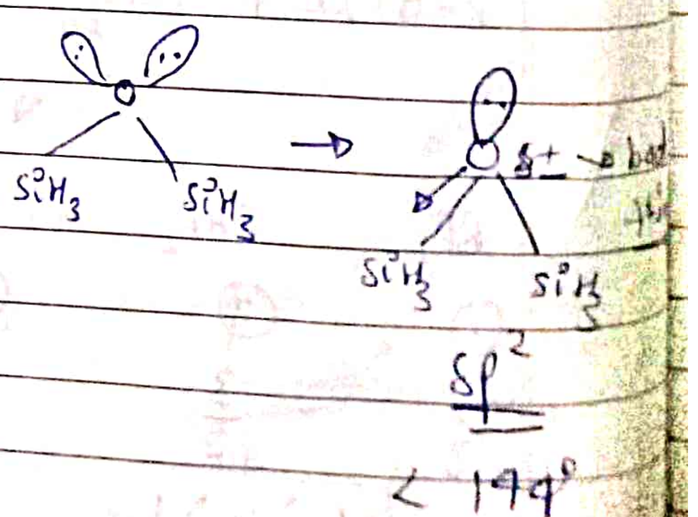
BO → 1.33	1

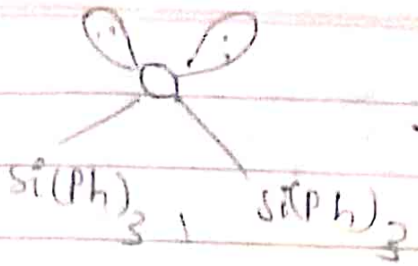
→ Hybridisation due to B-B may change or remain same →

\# if acceptor site ~~is~~ has no loan pair ~~involved in P/~~ & vacant orbital is present then don atom hybridisation will change









$\rightleftharpoons Si(Ph)_3 - \overset{+}{O} \rightarrow Si(Ph)_3$

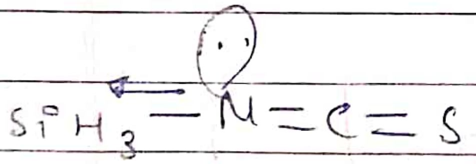
sp

$\underline{BeF_2}$ → back bonding

$F \rightarrow Be \leftarrow F$

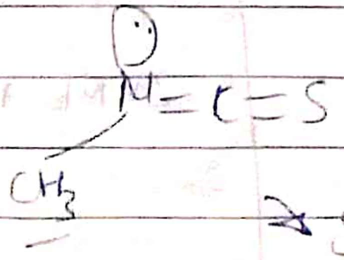
Q → which of the give statement is incorrect for SiH_3NCS →

~~(a) It is Si is sp^2 hybridised.~~
(b) Max^m no of atom in one plane is equal to 5.
(c) considering SiH_3 as a point. It is a planer species
(d) Both B & C are correct.

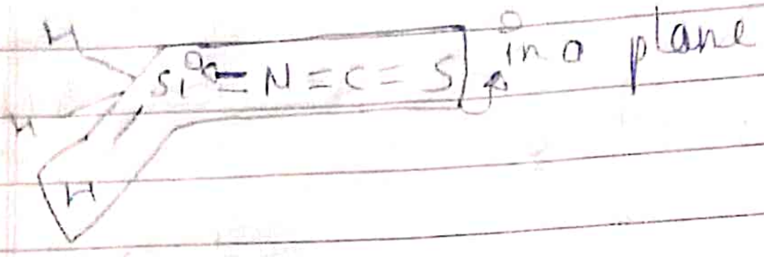


$SiH_3 - N = C = S$

No lean pair is present thus hybridisation will change to sp

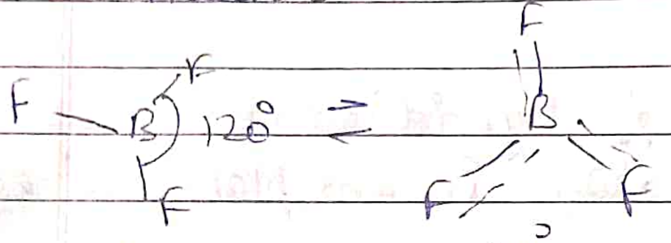


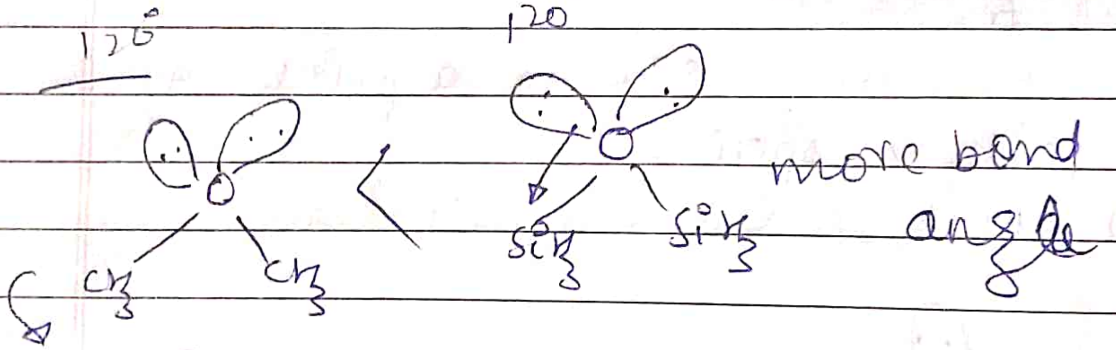
→ sp^2



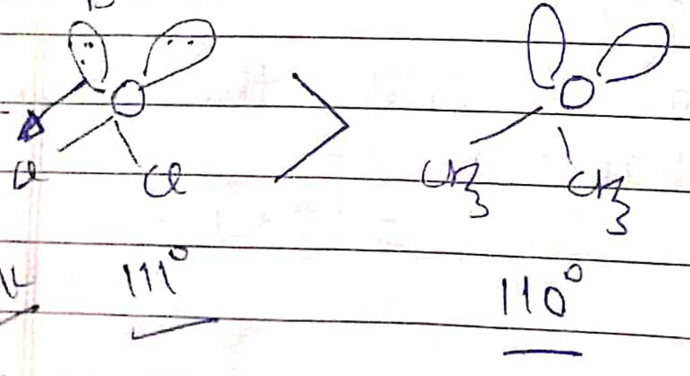
$N(SiH_3)_3$ is planer if we consider SiH_3 as a point group.

→ Due to BB, bond angle may increase or remain same.

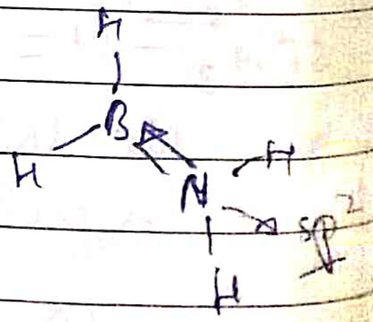




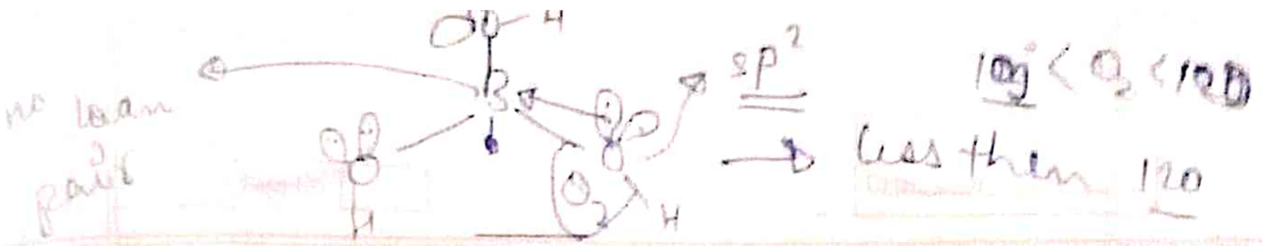
no BB



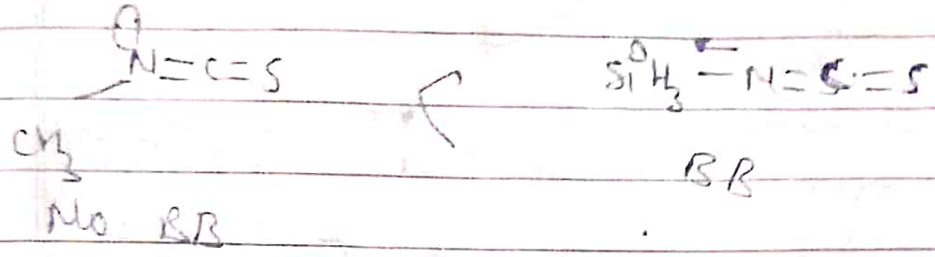
weak back bonding but hybridisation will not change



∠HNB → ~120



CH_3NCS SiH_3NCS



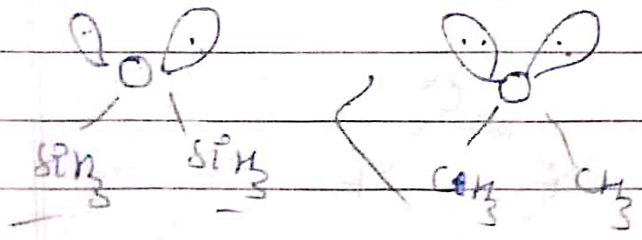
→ Due to back bond lewis acid character & basic character decreases →

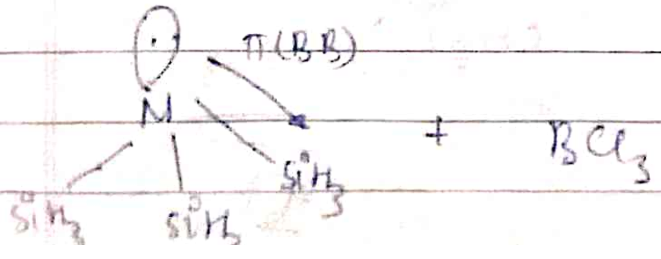
$BeF_2 < BeCl_2 < BeBr_2 < BeI_2$

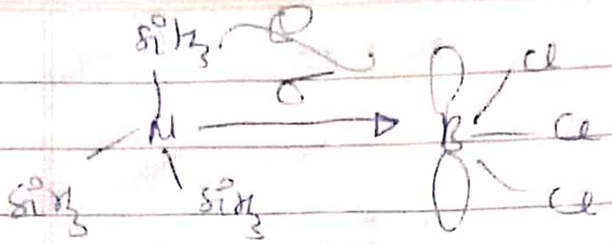
$BF_3 < BCl_3 < BBr_3 < BI_3$

$SiF_4 > SiCl_4 > SiBr_4 > SiI_4$

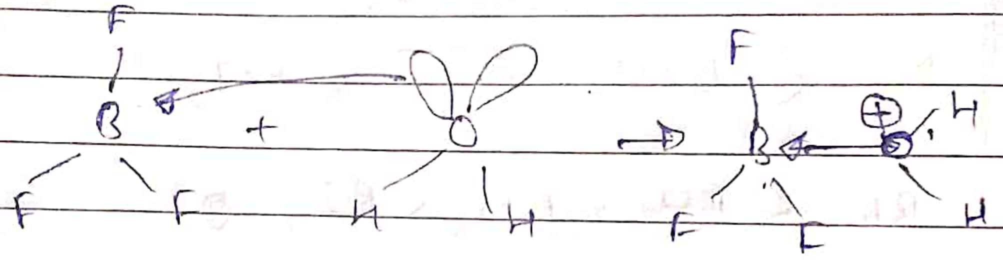
lewis basic character →





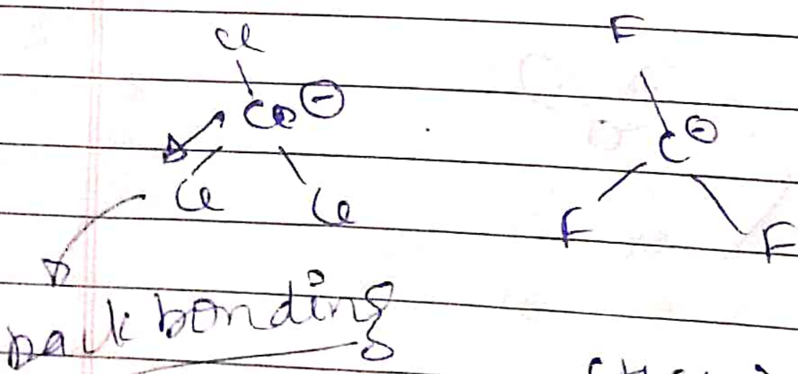


more favourable because loan pair is making σ bond inst of π dative bond due to BB



more stable

Due to back bonding acidity of aqueous acid ↑



thus

$CHCl_3 > CHF_3$

$SiH_3OH > C_2H_5OH$

↓ ↓

$SiH_3O^{\ominus}$ $C_2H_5O^{\ominus}$

↓

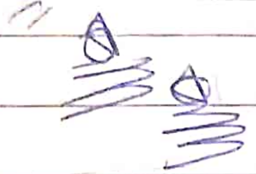
more stable

<u>BB</u>

extent of BB.

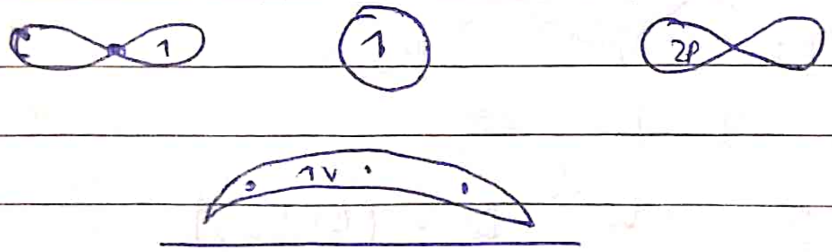
$\boxed{BH_2F > BHF_2 > BF_3}$ → Bond order

$\propto$ stability

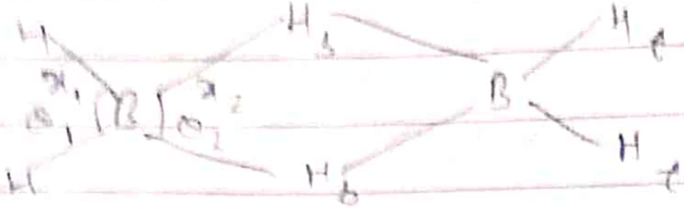


Bridge bonding →

electron deficient compound involved in bridge bonding or compound which is unstable in it's monomer form.



bond length ∝ sum of shell / period



$B \rightarrow sp^3$

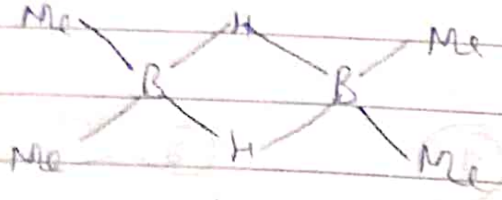
Max^m no of of atom in one plane = 6

Bond length $x_2 > x_1$

Bond energy → $B-H_b > B-H_t$

Bond ~~ens~~ energy ∝ $\frac{1}{\text{bond length (Only 2 C)}}$

$B_2H_6 \xrightarrow[\Delta]{\text{Methylation}} B_2(CH_3)_4H_2$



$\xrightarrow{\Delta} (B(CH_3)_3)_2$

$\theta_2 < \theta_1$

$\downarrow$ 97° $\downarrow$ 121°

amine (NH_3 | RNH_2 | R_2NH)

B_2H_6 + A (O → [OH^-] } → unsymmetrical cleavage

CN⊖

B_2H_6 + Rest Nu^- $\xrightarrow{R.T.}$ Symmetrical cleavage

↓

R_3N / H_2O | CO | PH_3 | PF_3 | Pyridine | ether / thioether

IT

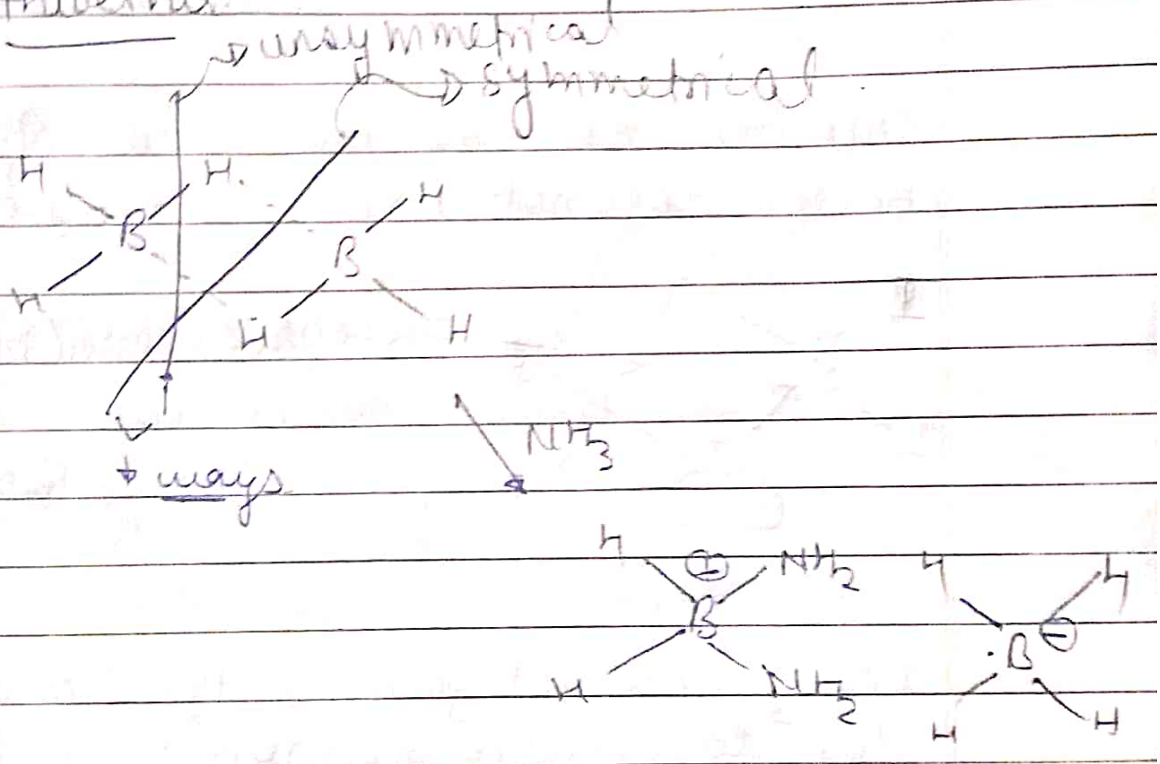
g can do

↓

g will

IIT

any H ✓



$\boxed{B_2H_6 \cdot 2NH_3}$ ← $[BH_2(NH_3)_2]^+ (BH_4^-)^-$

ionic bond

$B_2H_6 + (CH_3)_3N \rightarrow 2BH_3 \leftarrow N(Me)_3$

or

$B_2H_6 \cdot 2N(CH_3)_3$

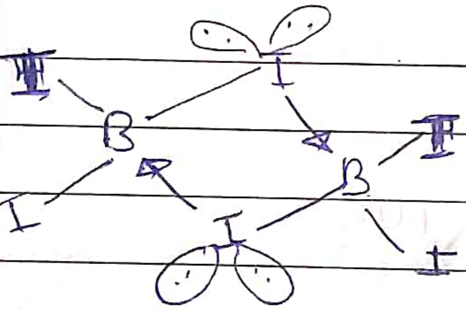
$B_2H_6 + H_2O \longrightarrow B(OH)_3 + H_2 \uparrow$

$B_2H_6 \xrightarrow{NH_3 (excess)} B_2H_6 \cdot 2NH_3$

$B_2H_6 \xrightarrow[\text{High temp}]{NH_3 (excess)} (BN)_x$ inorganic graphite

$B_2H_6 \xrightarrow[\Delta]{2NH_3} B_3N_3H_6$ inorganic benzene

Chloride | Bromide and iodide of Boron does not form bridge bond →



stearic repulsion so it does not form bridge bond.

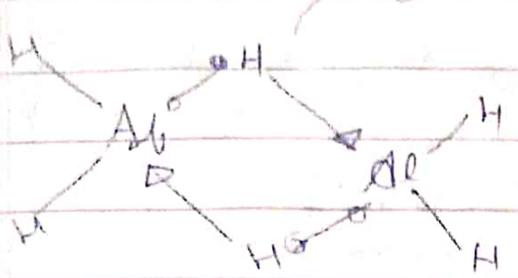
$B(Me)_3$ does not form bridge bond due to stearic reason.

* Compounds of aluminium Berilyum will also do same.

(i) hydrides of aluminium →

$(AlH_3)_n \xrightarrow{\Delta} Al_2H_6$

solid (liq or vapour)



banana or bridge bond.

→ Al → sp^3, CN=4, (2c,2e) → 4

→ (3c,2e) → 2.

→ Non planer.

→ max^m no of atom in a plane → 6

→ $\mu = 0$ non polar.

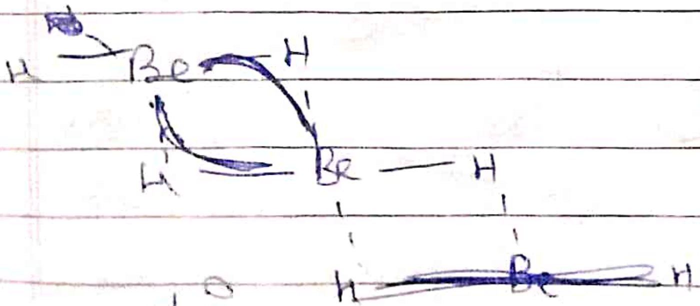
(AlH_3) in ~~dimeric~~ polymeric form CN=6 $\underline{\underline{sp^3d^2}}$

Hydride of 'Be' →

$$(BeH_2)_n \xrightarrow{\Delta} \underline{Be_2H_4} \longrightarrow \underline{BeH_2}$$

<u>solid</u> (liq|vap) vap)

dimer.

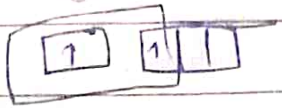


dimer

3c - 2e⁻ → 2

2c - 2e⁻ → 2

polymeric form $(BeH_2)_n$



CN → 4 , sp^3

Halide of Aluminium →

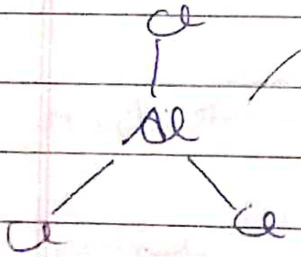
AlF_3 → Ionic → % IC → >50% →

no bridge

$\Delta\chi$ > 2 ionic

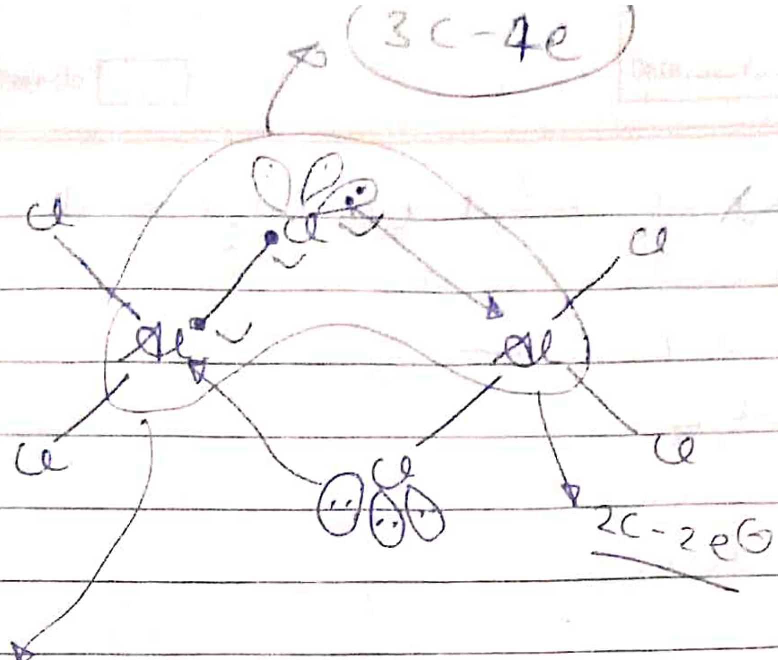
→ $(AlCl_3)_n \xrightarrow{\Delta} Al_2Cl_6 \xrightarrow{\Delta} AlCl_3$

solid	dimer liq/vap)	monomer gas



→ no back bonding because both are from 3rd shell

liq/vap →



sp^3 CN=4

No of 2c-2e⁻ → 4

" " 3c-2e⁻ → 0

" " 3c-4e⁻ → 2

$\boxed{\text{Non planar. } \mu = 0}$

($AlCl_3$) polymeric form

CN of Al → 6 sp^3d^2

$\boxed{3c-2e^- \to 0}$

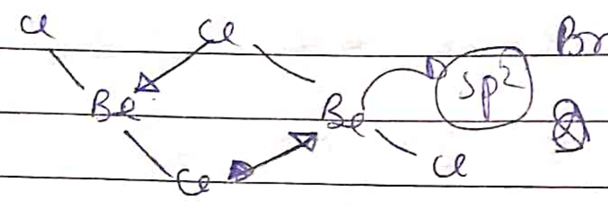
all are 3c-4e⊖

$AlBr_3$ & AlI_3 exist as dimer in solid also.

$(BeX_2)_n \xrightarrow{\Delta} (BeX_2)_2 \xrightarrow{\Delta} BeX_2$

X → Cl, Br, I →
CN → 4
no stearic
hinderance.

→ $(BeF_2)_n$ (solid) look like silicate str.



Bridge coordinate bond

→ No of 3c-2e⁻ → 0
2c-2e⁻ → 2
3c → 4e⁻ → 2

planer

BeH_2
↓
in polymeric
form all are
3 centre 2 el.

→ polymeric form →

No of 2c-2e⁻ → 0
all are 3c-4e⁻ ✓ 8
Non plane- sp³

$Al_2(CH_3)_6$
↓
has
3 centre
2 electron
bond

BeF_2 form bridge bond.
↓ covalent.

Note →

$AlCl_3$ (s) is covalent (solid) but in aq sol^n. It is ionic in nature.

$$AlCl_3 + H_2O \rightarrow [Al(H_2O)_6]^{3+} (aq)$$

in $[Al(H_2O)_6]^{3+}$ has weak coordinated water.

$$AlCl_3 + H_2O \rightarrow [Al(H_2O)_6]Cl_3 \rightarrow [Al(H_2O)_5OH]$$

+ HCl

↓

acidic

aqueous sol^n of $AlCl_3$ is acidic in nature.

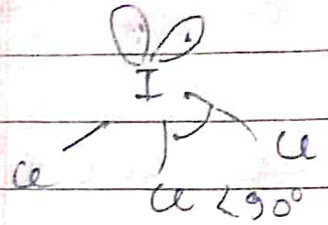
→ $FeCl_3$ bonding is siminatar $AlCl_3$.

$$\underset{\text{solid}}{(FeCl_3)_n} \xrightarrow{\Delta} \underset{\text{liq/vap}}{(FeCl_3)_2} \xrightarrow{\Delta} \underset{\text{gas}}{(FeCl_3)}$$

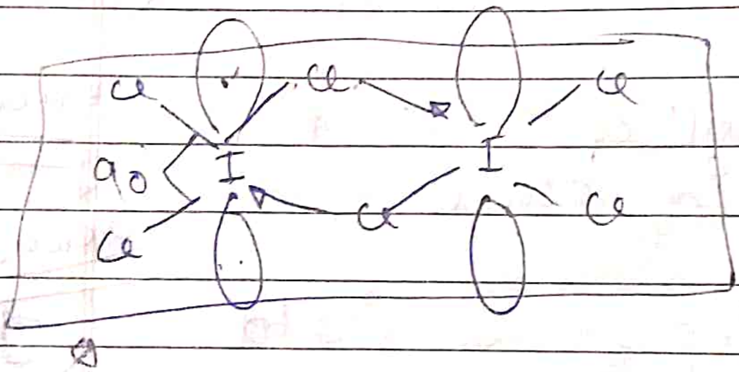
$$\underbrace{\underset{(s)}{FeCl_3} + H_2O \rightarrow [Fe(H_2O)_5OH]^{2+}}Cl_2$$

also acid in natur in aqueous sol^n.

ICl_3 (monomer) and exist as dimer in liq (I_2Cl_6)



dimer →



planer

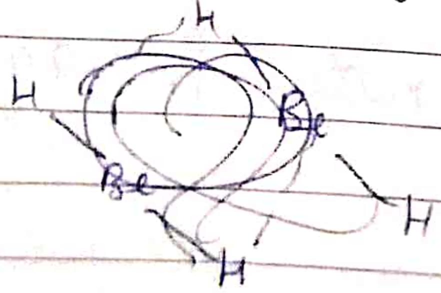
$\mu = 0$

more stable than monomer

lp - lp — 180°

∠ Cl I Cl → 90

~~BeH_2 → solid form~~



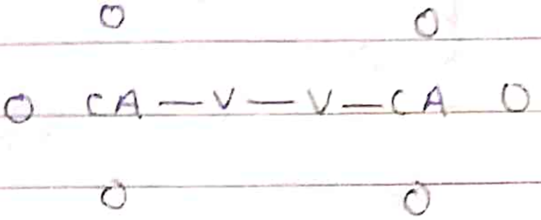
27/10/2020 B.

Structure drawing

For one central atom →

symmetrically placed around C.A.

For two centre atom →



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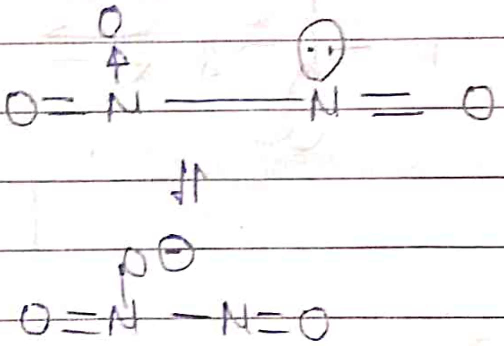
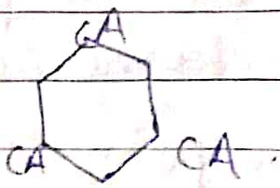
N_2O_3

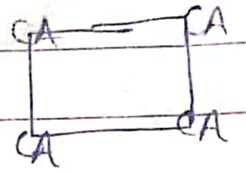


For central atom →

if (No of CA < No of bonded atom)

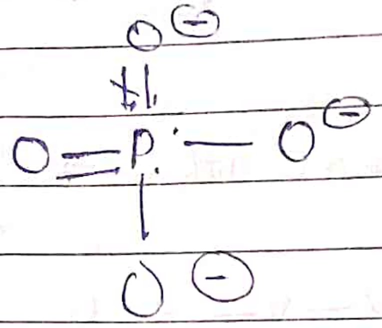


For 4 central atom →

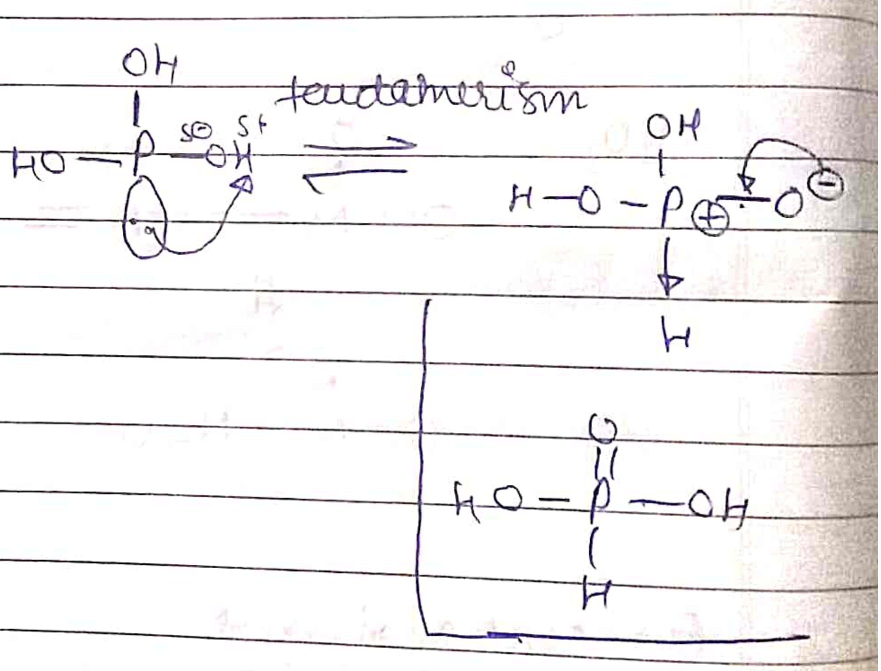


For one central atom →

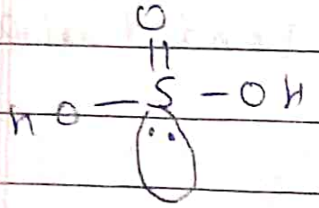
→ PO_4^{3-} ⇒



H_3PO_3 →



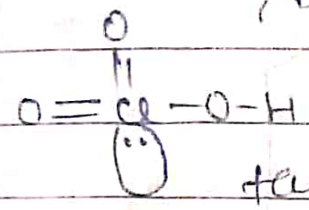
→ H_2SO_3



→ there is possibility of tautamerism but it is major product

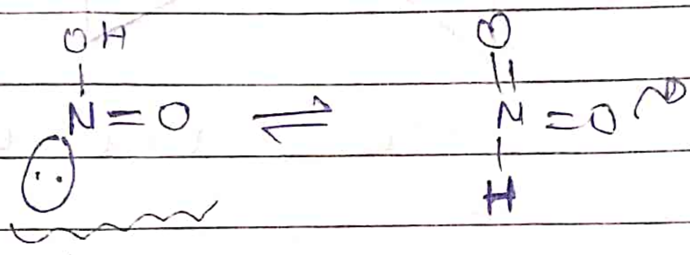
$HClO_3$

→ major



→ can undergo the process of tautamerism but & ~~do~~ e donating capability of Cl is minor so.

HNO_2 →

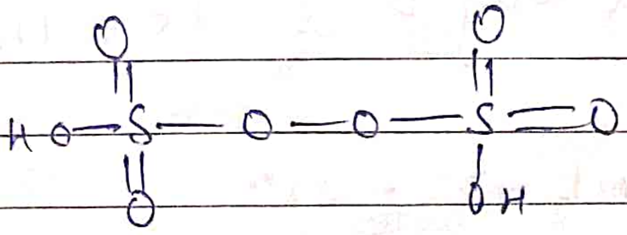


5 bonds in N is not possi

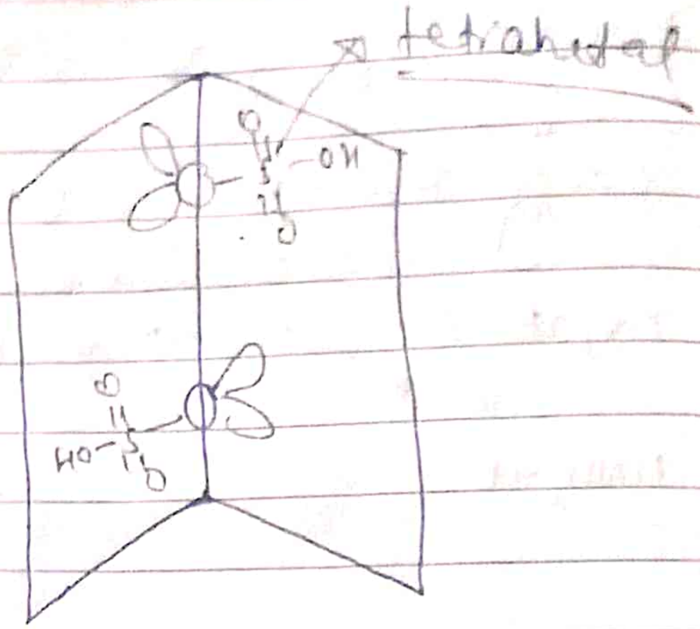
no tautamerism

structure for two central atom →

$H_2S_2O_8$ →

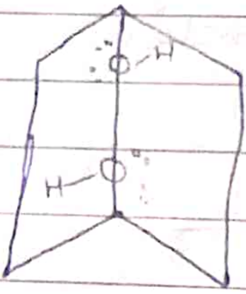


Note → when two c.n. like —O—O— or —S—S— are present then ~~thus~~ they are open book like structure.



max^m 5 atom are in a plane

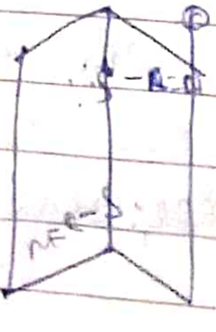
H_2O_2 →



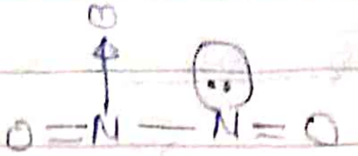
3 atom in a plane

similarly → S_2F_2 | S_2Cl_2 | H_2S_2 | O_2F_2 etc

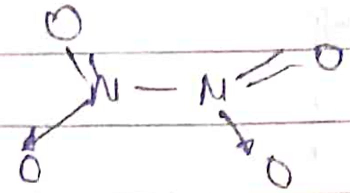
$(SCN)_2$ → max^m



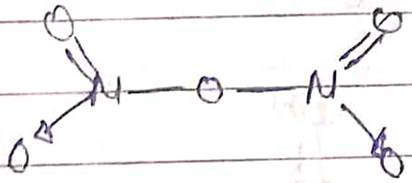
N_2O_3 →



N_2O_4 →

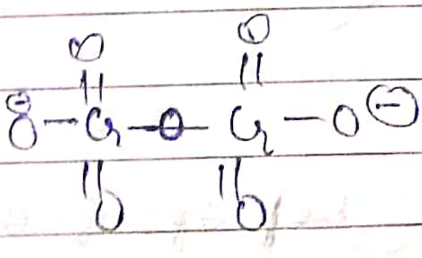


N_2O_5 →

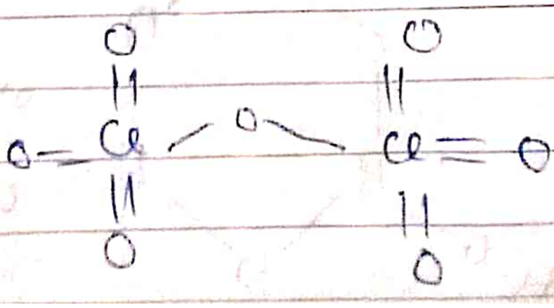


$Cr_2O_7^{2-}$

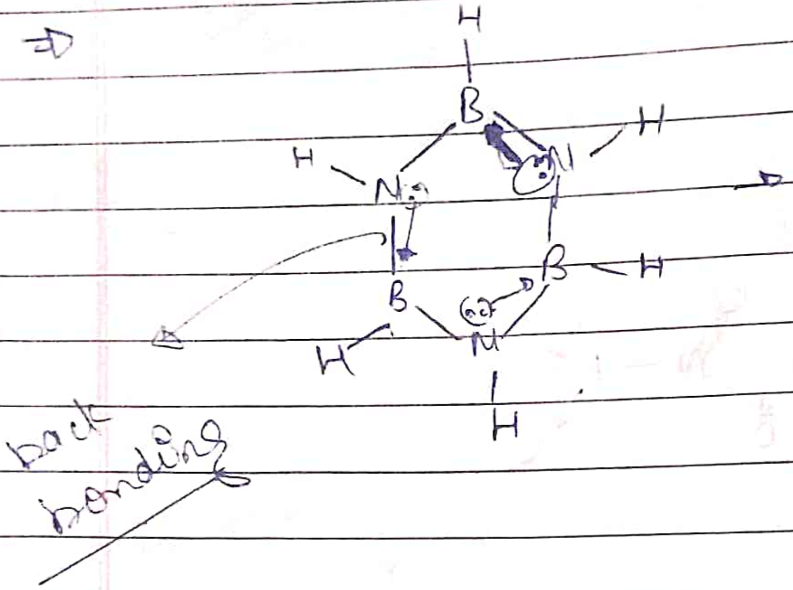
eq no of ↑Cr–O
↓ 6



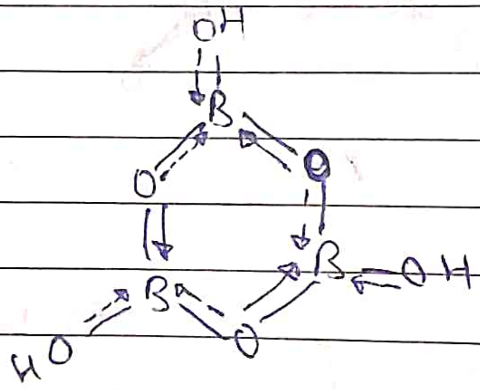
Cl_2O_7 →



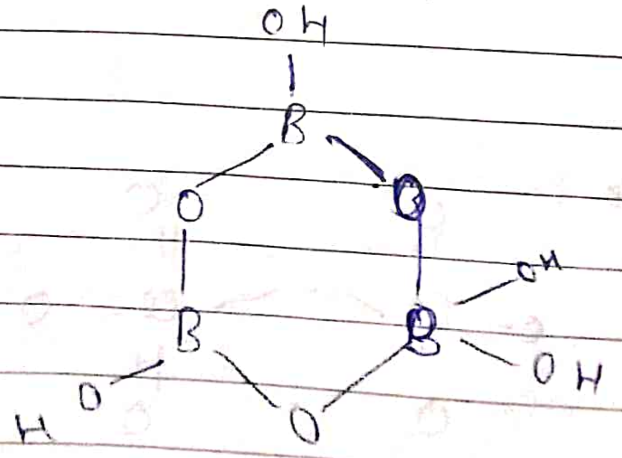
Structure of B-centre → less electronegative is central atom



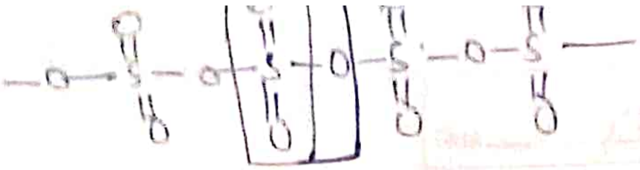
② $B_3O_3(OH)_3$ →



③ $[B_3O_3(OH)_4]^{\ominus}$ ~~no. of B-O-B bonds~~



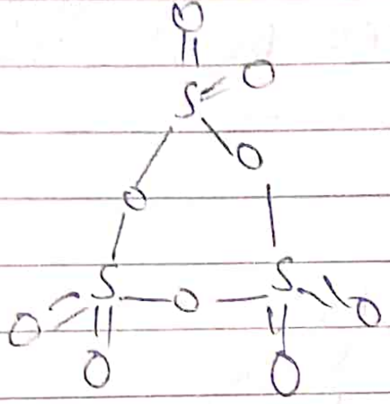
2 boron atom are involve in back



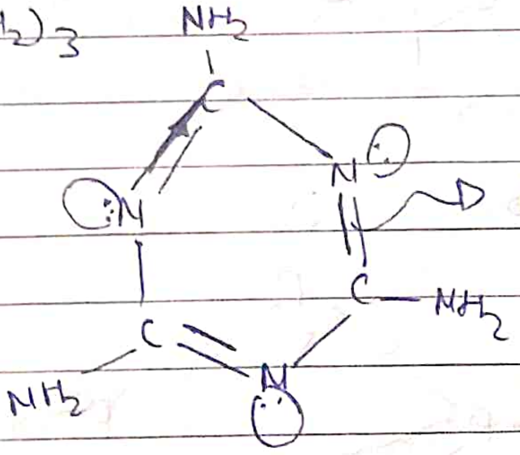
$(SO_3)_3$ → α-SO_3 | β-SO_3 ↗

(SO_3) (solid) → γ-SO_3 $(SO_3)_3$.

S_3O_9 →



$C_3N_3(NH_2)_3$



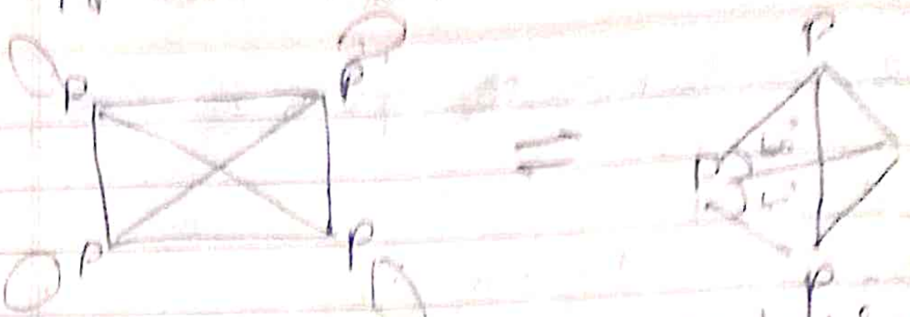
pure π not BB ⇓ ③ total

(melamine)

no of B-B = 0 = 0

Structure for 4- central atom

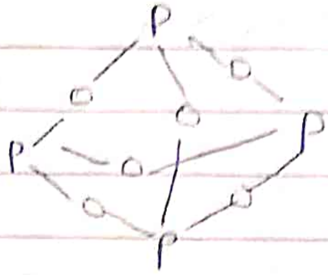
P_4 → white phosphorus



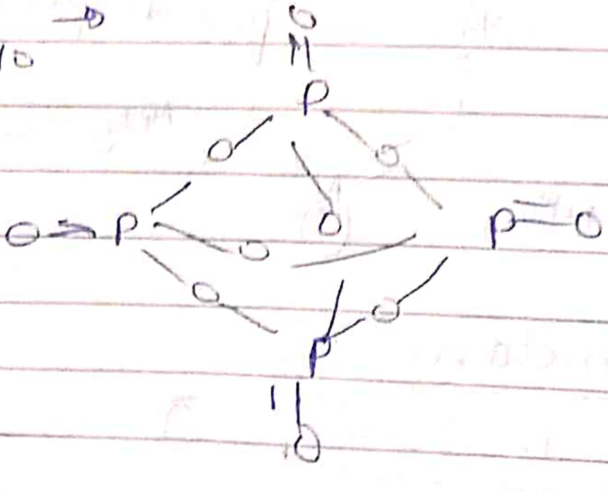
very unstable.

No of ∠60 bond angle → 12

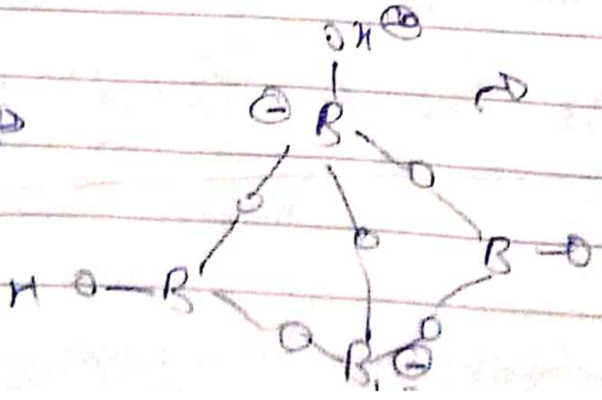
P_4O_6 →



P_4O_{10} →



Borax →



→ sp^3 'B' → 2

sp^2 'B' → 2

Back bonding
↓
2

oxoacids of phosphorous →

anydride

H_3PO_4 → basidity → 3 → P_4O_{10}

H_3PO_3 → " → 2 . P_4O_6 anhydride

H_3PO_2 → " → 1

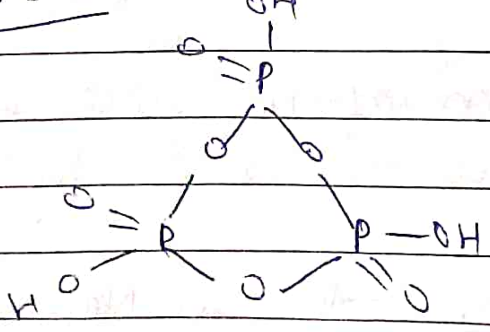
$H_3PO_4 \xrightarrow{-H_2O} HPO_3$ → metaphosphoric acid

→ metaphosphoric acid exist in polymeric acid ie $(HPO_3)_3$, $(HPO_3)_4$ --

→ $(HPO_3)_3$ → trimetaphosphoric acid.

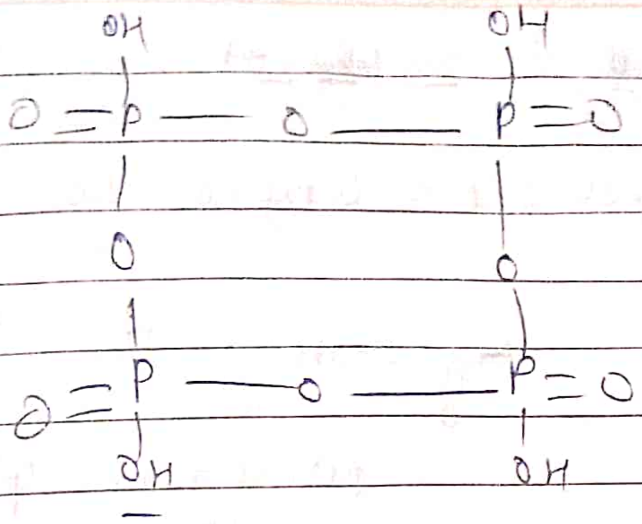
↓

$H_3P_3O_9$

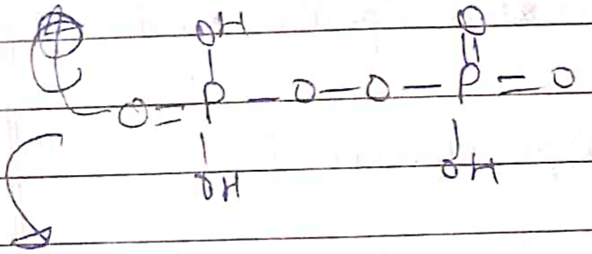


$(H_3PO_3)_4$ → $H_4P_4O_{12}$ terameta phosphoric acid

Hypo+ic (O) ic to di+peroxo +ic



$H_4P_2O_6$ → ~~hypophosphoric acid~~.

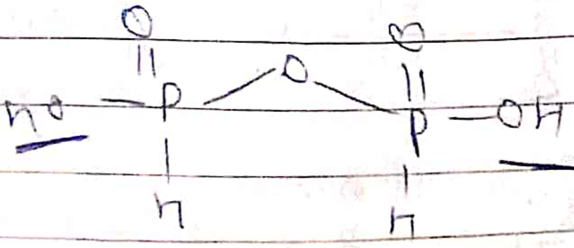


$H_4P_2O_8$ → ~~diphosphoric acid~~

peroxodiphosphoric acid.

→ $H_4P_2O_5$ → pyrophosphorous acid.

diphosphorous acid.



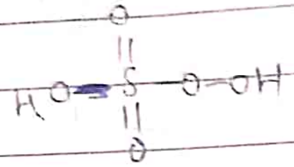
basicity → 2

Oxoacid of Sulphur →

Highest O.N = Group no − 10.

06

H_2SO_5



$HO-S(=O)_2-O-OH$

peroxomonosulphuric acid

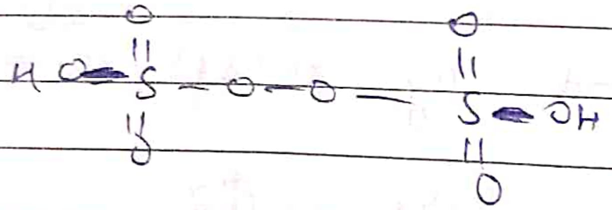
$H_2S_2O_7$ → disulphuric acid / pyrosulphuric acid

~~H_2O~~ $H_2S_2O_8$ → peroxodisulphuric acid.

$H_2S_2O_6$ ⇒ hyposulphuric acid.

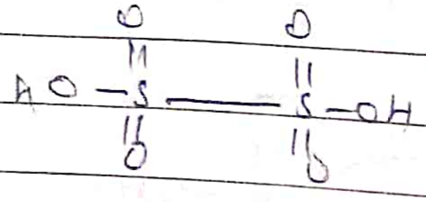
S_a series → $H_2S_{n+2}O_6$ $n = 0, 1, 2 \ldots \infty$)

polythionic acid.



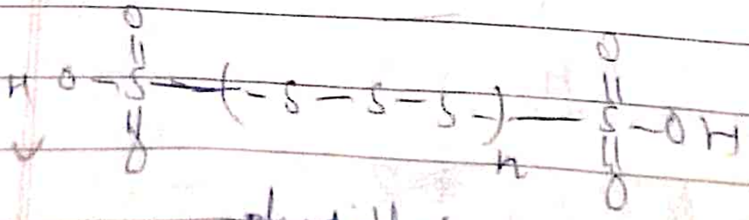
$HO-S(=O)_2-O-O-S(=O)_2-OH$

$H_2S_2O_6$



$HO-S(=O)_2-S(=O)_2-OH$

hyposulphuric aci

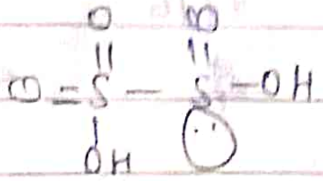


$HO-S(=O)_2-(-S-S-S-)_n-S(=O)_2-OH$

polythionic acid

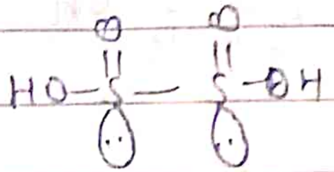
$H_2S_2O_6$ → dithionic acid   tetra
$H_2S_3O_6$ → trithionic acid.   penta –
$H_2S_4O_6$ → tetrathionic acid

$H_2S_2O_5$ ✓
↓
pyrosulphuras acid / disulphuras acid.



→ drivative of sulphuras acid.

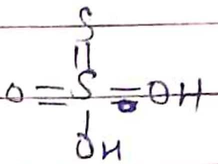
$H_2SO_4 + S$
↓
$H_2S_2O_4$ →



thiosulphuric acid.

$H_2S_2O_3$ →

$H_2SO_3 + S \rightarrow H_2S_2O_3$



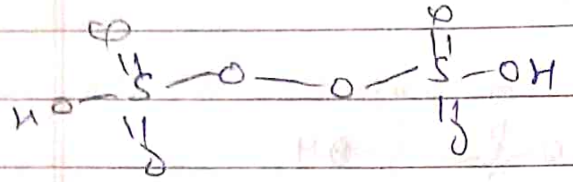
~~thiosulphuras acid~~

calculate the value of the expression $\frac{P^2+Q^2}{R+1}$ where P → total no of species ~~posses~~ shows per oxo linkage, oxy
Q → total no of species shows basicity greater than 0 and R → total no of polar species

$H_2S_2O_8$, $H_4P_2O_5$, $H_4P_2O_7$, H_2SO_5, ~~H_3PO_4~~,
PO_4^{3-}, $(CN)_2$, $(SCN)_2$

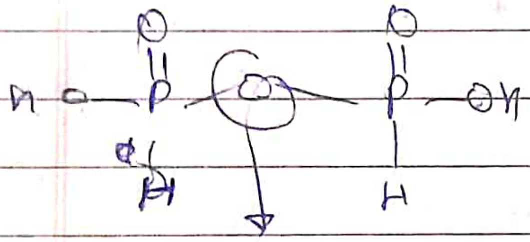
P → 2
O = 4
R = 7

$\frac{4+16}{4} = \frac{20}{4} = \frac{20}{4} = 5$ Ans



polar

$H_2S_2O_5$ → polar



oxo

non polar

PO_4^{3-} → non polar

$(CN)_2$ →
pseudo halid & halogen structure are written in the same form as written →

Psudohalid → poly atomic species containing at least N.

eg - ~~$(SCN)_2$~~, ~~$(CN)_2$~~

boric acid is not monoprotic but mono basic

→ non polar

$N \equiv C - C \equiv N$ all are in a plane (linear)

$(SCN)_2$ →

~~S ———~~ S C N

$N \equiv C - S - S - C \equiv N$

↓

polar

ionic →

Complete transfer of electron take place between different species.

~~Ion~~ Ionic Solid →

$PCl_5(s) \rightleftharpoons [PCl_4]^+ (PCl_6)^-$

$PCl_5(s) \rightleftharpoons [PBr_4]^+$ [~~PBr6~~]$^-$ Br^-

$Cl_2O_6(s) \rightleftharpoons (ClO_2)^+ (ClO_4)^-$

$N_2O_5(s) \rightleftharpoons (NO_2)^+ (NO_3)^-$

$N_2O_4(s) \rightleftharpoons (NO)^+ (NO_3)^-$

$N_2O_3(s) = (NO^+) (NO_2)^-$

$XeF_6(s) = (XeF_5)^+ (XeF_7)^-$

$(XeF_5)^+ (F^-)$

Theoretically Ionic bond →

→ non directional

Fajan's →

Ionic compound posses some covale
character, Qualitatively :

Fajan's explained →

in Ideal case (considering compound 100% ionic) ~~oxe~~ electronic cloud of carbon and anion in ionic compound have symmetri
l distribution.

soft sphere

But in real case anionic e^- cloud move towards (diffuse) cationic species (Hard sphere) and create directional natu
i.e covalent character.

→ tendency to attract $e^{\ominus}$

: polarising power / Ionic potential
(define for cation)

+

Polarisability → defined for anion
tendency to diffuse

both process term as polarisation

Factor on which polarisation → depends

☆ Polarisability = charge ↑ | size ↑
(anion)

polarisability :

$C^{4-} > N^{3-} > O^{2-} > F^-$ Q.

$F^- < Cl^- < Br^- < I^-$ Q.

(M) Polarising power / Ionic potential :

depends on cationic charge density ↑

size → $\phi = \frac{\text{charge}}{\text{density}}$ $\boxed{\frac{\text{charge}}{\text{size}\downarrow}}$ $\phi\uparrow$

polarising power.

$Na^+ < Mg^{2+} < Al^{3+}$

$Li^+ > Na^+ > K^+$

~~Data~~ →

→ polarising power depend on e^- configuration

$(n-1)s^2$ or $(n-1)s^2(n-1)p^6$ → noble gas configuration

$(n-1)s^2(n-1)p^6(n-1)d^{10}$ → pseudo noble gas configuration

$(n-2)f^{10}$

Non - inert gas configuration

$(n-1)s^2 \ (n-1)p^6 \ (n-1)d^{10} \ \underline{ns^0}$.

<u>Conclusion of polarising power (Zeff)</u> →

steps →

1 → configuration — if different configuration then

to compare it look for charge more ⊕ charge more polarising power.

→ pseudo noble gas
→ Non inert
→ partially filled d

> Noble gas configuration except (Al^{3+}, Be^{2}

all these will always win over noble gas configuration

ϕ → $Fe^{2+} > Na^+$

// $Fe^{2+} > Ca^{2+}$ → noble gas configuration

partially filled 'd'

// $\underline{Na^+} < \underline{Zn^{2+}}$

$K^+ < \underline{Pb^{4+}}$

if configuration is same then use general concept.

~~$Zn^{2+} > Cd^{2+} > Hg^{2+}$~~

→ in d block Z_{eff} down the group ↑

→ $Zn^{2+} < Cd^{2+} < Hg^{2+}$ ①

$Al^{3+} > Pb^{2+}$ } → exception
$Al^{3+} > Fe^{2+}$ } same with Be^{2+}

→ don't have

Application of Fajan's rule →

→ covalent and ionic character in ionic compound →

Polarisation & covalent character in ionic compound.

Q→ which of the given order is correct → in term of covalent character

(a) $LiF < NaF < RbF < CsF$

(b) $BeF_2 > MgF_2 > CaF_2 > SrF_2 > BaF_2$

(c) $ZnCl_2 < CdCl_2 < HgCl_2$

d) $PbCl_2 > PbCl_4 < AlCl_3$

~~which~~ .

→ $Li_3N > Li_2O > LiF$ covalent charac

→ $BeCl_2 < MgCl_2 < CaCl_2$ → ionic characte

→ $AlCl_3 < MgCl_2 < LiCl < NaCl$

ionic

⇒ thermal stability of ionic compound →

energy required to break bond.

Case-I → Ionic compounds having monoat
-mic anion.

TS →

$LiF > NaF > KF > RbF > CsF$

$LiCl > NaCl > KCl > RbCl > CsCl$

// $TS \propto L.E \propto \frac{Kq_1q_2}{r_1+r_2}$

$Li_3N > Na_3N > K_3N > Rb_3N > Cs_3N$

$Li_2O > Na_2O > K_2O > Rb_2O > Cs_2O$

$r_c \downarrow \rightarrow T_s \uparrow$

TS → LiI > NaI > KI > RbI > CsI

Trick →

in case of thermal stability (monoatomic anion = small, polyatomic anion = large)

→ small small or large - large → more stable

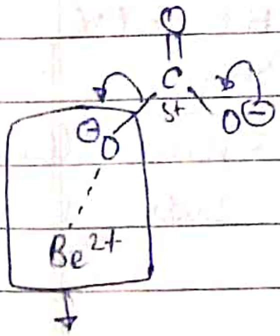
→ small → large → less stable

Case-2 → Ionic compound posses polyatomic anion → (CO_3^{2-}, SO_4^{2-}, O_2^{2-}, O_2^{-}, $NO_3^{\ominus}$, ClO_4^{-} etc)

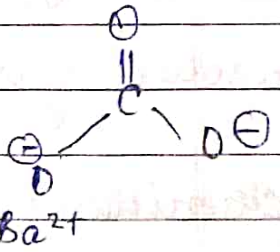
Q. // $TS \propto \frac{1}{\text{polarisation}}$

MCO_3 (M → Group II metal ion)

→ $BeCO_3 \xrightarrow{\Delta}$ $\qquad$ $BaCO_3 \xrightarrow{\Delta}$



→ $BeO + CO_2$



Since polarising power of Be^{2+} is more

Since polarising power of Ba^{2+} is less than Be^{2+} so to break we will need more energy to break $BaCO_3$ as compared to $BeCO_3$.

polyatomic OH

$Li_2CO_3 < Na_2CO_3 < K_2CO_3 < Rb_2CO_3 < Cs_2CO_3$ T.S ↓

$BeCO_3 <$ ~~Ba~~ $MgCO_3 < CaCO_3 < BaCO_3 < SrCO_3$

Solubility of Ionic compound →

→ Solubility →

more Ksp → compound more soluble → solubility

Qualitatively, solubility depends upon →

→ various factor like polarisation, L.E, H.E, entropy, etc

majorly Solubility depends on

polarisation

L→ solubility ∝ I.C ∝ $\frac{1}{C.C}$ ∝ $\frac{1}{polarisation}$

→ dominates in case of pseudo/d-block element/ non inert

→ In case of p/d block ~~element~~ compounds are there use polarisation.

H.E + L.E

↓

S block element use it

polarisation will not acts where noble gas cation are present - (s block)

Case I →

Polarisation is dominating factor →

$AgF > AgCl > AgBr > AgI$

↓ polarisability ↓

→ C.C ↓

→ I.C ↑

↓ solubility ↓

character

$HgF_2 > HgCl_2 > HgI_2$ → solubility

Solubility $PbCl_2 > PbCl_4$

$PbCl_2 > PbBr_2 >$ ~~PbB~~ PbI_2

Case - 2 → Born Linde equation for s-block compound →

↓ Trick (only for s block compound)

↓

Small - large or large - small are more soluble than small - small and large - large

$LE \Rightarrow \frac{K q_1 q_2}{r_a + r_c}$

assume anion as large except $F^{\ominus}$ $OH^{\ominus}$.

$\Delta H_{total} = \Delta H_{LE} + \Delta H_{HE}$

$$\boxed{\Delta H_{total} \propto = \frac{1}{r_a + r_c} - \frac{1}{r_a} - \frac{1}{r_c}}$$

spontaneous(solubility) ∝ $\underline{\Delta G = \Delta H - T\Delta S}$
↓
total

Case No 1 ⇒

$\Delta H_{total} =$

$|\Delta H_{LE}| > |\Delta H_{hyd}|$

spontaneous ∝ solubility ↓

→ Solubility of compounds $r_a >>> r_c$

⇒ $LiClO_4 > NaClO_4 > KClO_4 > RbClO_4 > CsClO_4$

$\Delta H_{total} = \cancel{\frac{1}{r_a}} - \cancel{\frac{1}{r_a}} - \frac{1}{r_c} = -\frac{1}{r_c}$ ∝

$(r_a >>> r_c)$

this is from hydration

then we can say that $\Delta H_{hyd} > \Delta H_{LE}$ in magnitude.

→ Ans

thrick → for solubility assume all anion to be ~~very~~ large (except OH, F)
↓
(Small size anions)

solubility →

① $LiNO_3 > NaNO_3 > KNO_3 > RbNO_3 > CsNO_3$

② $BeS_2O_3 > MgS_2O_3 > CaS_2O_3 > SrS_2O_3 > BaS_2O_3$

③ $BeCO_3 > MgCO_3 > CaCO_3 > SrCO_3 > BaCO_3$

④ $LiX > NaX > KX > RbX > CsX$ (X = Br/I)

$LiOH < NaOH < KOH < RbOH < CsOH$

$Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$

$BeX_2 > MgX_2 > CaX_2 > SrX_2 > BaX_2$

$X_2 \to Cl^-, Br^-, I^-$

Q → incorrect →

(a) In alkali metal iodide solubility ↑ down the group. due to ↑ in LE.

(b) in alkali metal iodide solubility ↓ due to ↑ in LE. down the group

(c) In alkali metal iodide solubility ↓ due to ↑ in HE.

a) ~~None~~ All of these ✓ ⓐ

Ba

$BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

↳ H.E decreasing.

$LiOH < NaOH < KOH < RbOH < CsOH$

$\Delta H_{Hy} = -\frac{kq_1q_2}{r_c \uparrow} \downarrow$ less ~~soluble~~ (−)ive

$L.E = \frac{kq_1q_2}{r_c + r_a} \downarrow$ ✓

→ due to decrease in L.E.

Q → $BeSO_4$ is soluble and $BaSO_4$ is insoluble in water at 25°C because -
low H.E of $BaSO_4$

→ $LiNO_3 > CsNO_3$ Solubility →

⇒ due to decrease in H.E.

exceptions in solubility →

→ alkali metals compounds →

sulphates

↑

(1) ~~carbonates~~

B S C ——→ opposite order.

B ↓ bicarbonate

C ↓ carbonate

It → $Li_2CO_3 < Na_2CO_3 < K_2CO_3 < Rb_2CO_3 < Cs_2CO_3$

$NaHCO_3 < \; < \; < \; < CsHCO_3$

$Li_2SO_4 < \; < \; < \; < Cr_2SO_4$

Fluorides →

$LiF < NaF < \underbrace{RbF < KF} < CsF$

Clorides →

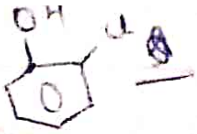
$LiCl > CsCl > RbCl > NaCl > KCl$

Li SA Ray Ne Kiya

ALKALINE EARTH METAL →

$F^- \rightarrow BeF_2 > BaF_2 > SrF_2 > CaF_2 > MgF_2$

$SO_4^{2-} \rightarrow BeSO_4 > BaSO_4 > SrSO_4 > CaSO_4 > MgSO_4$



Molecular Forces (weak forces) B.E. ≤ 42 KJ/mol

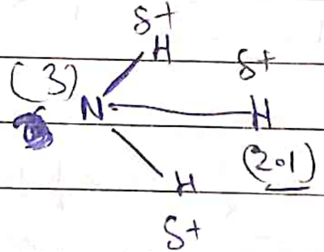
→ **HYDROGEN BONDING** →

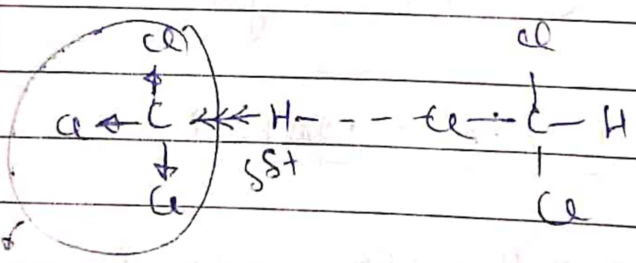
It is a weak interaction b/w H-atom $H|O|F|CCl_3|CF_3|CN|$ sometime Cl (o-hydroxy phenol)

E.N ≥ 3

According to modern concept →

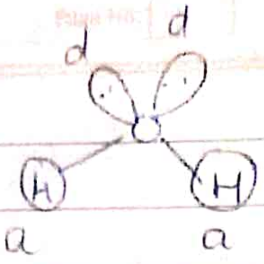
H-bonding is defined as weak interaction b/w L-acid and L-base



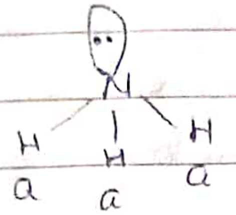


$\chi = 3.14$

No of H-bond → No of acceptor site (H atom) + No of donar site (loan pair)



no of H-bond per H_2O molecule
⇒ 4.



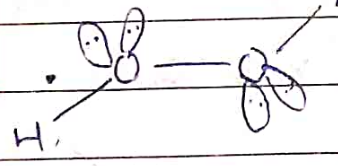
no of H-bond per NH_3 molecule ⇒
= 2

no of acceptor = 3
no of donar = 1.

since no of donar is less so process will happan according to donar so.
No of H bond = 1+1 = 2.
⇒

$\boxed{\text{no of donar = no of acceptor}}$
⇓
if this is not equal then take ~~equa~~ minimum value of each.

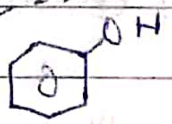
H_2O_2 ⇒



no of donar = 4
no. of acceptor = 2.
no of H-bond = 2+2 = ④
Ans.

Q- calculate no of molecules undergo H-bonding and formed no of H-bond ≥ 2.

⇒ HCN, C_2H_5OH, CHF_3, $CHCl_3$,



, HCHO

CH_3COOH, CH_3COCH_3

Sol^n ⇒ 6 Ans

→ sp hybridise EN↑ ?

H–C≡N → will form H bonding

Types of H-bonding –:

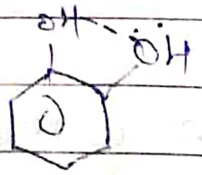
Based on molecularity
- → intermolecular H-Bonding
- → intramolecular H-Bonding

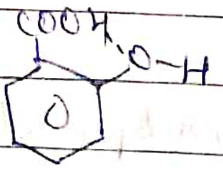
Based on B.E.
- → symmetrical H-Bonding ($BE>42$)
- → unsymmetrical H-bonding ($8<BE<42$)

✱ Intermolecular-H-bonding →
H-bonding take place b/w molecules
eg → H_2O-H_2O, $N_2H_4-N_2H_4$, $HClO_4-HClO_4$ etc.

✱ Intramolecular H-bonding →
H-bonding within molecule.

eg





(condition: chelation (5/6 member)

N_2H_4 → it's chelation ring has 4 member so it don't form intra H bong good acuptor & good donar

similary in solid state H_3BO_3 form inter molecular not intra.

Physical property of molecule affected due to H- bonding →

① Boiling point. ④ solubility.
② M.P ⑤ critical temp
③ viscosity ⑥ ease of liquification.
⑦ vapour pressure.
(b) from '1' to '6' physical property

$\propto$ intermolecular

$\propto \frac{1}{\text{intramolecular}}$

extent of H- bonding $\propto$ (No of H-bonding) ① $\times$ strength of H-bond ②

① $HF--HF > H_2O--H_2O > NH_3--NH_3$.

② $F---\overset{\delta+}{H}-F < O---H-F < N--HF$
good donar.

③ $F-H--N > OH_2--O > NH_3-F$

Boiling point →

H_2O , HF NH_3 $\qquad$ $\underline{H_2O > HF > NH_3}$

4 $\quad$ 2 $\quad$ 2

\# no of H-bond is same then look for strength of H-bond.

② $H_2O > C_2H_5OH$

$\underline{4}$ $\qquad$ $\underline{2}$

③ $\overset{6}{\text{Glycerol}} > \overset{4}{\text{Glycol}} > \overset{4}{H_2O}$

↳ here we will look for surface area not strength. this is because ~~b/w~~ H-bonding b/w to atom (H & O) in both of molecules are same.

④ $\underline{\overset{4}{H_2SO_4}} > \underline{\overset{4}{H_2O}}$

↳ <u>surface</u> <u>area</u>

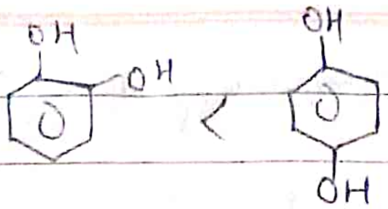
which of the given statement is correct →

(a) solubility in water:

$NH_2CONH_2 > CH_3CONH_2 > CH_3COCH_3)$

(b) ease of liquification

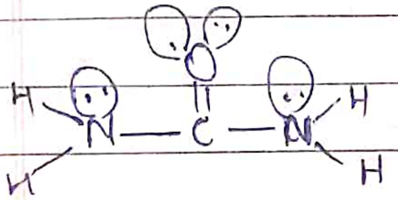
$H_2O > NH_3$



(C) T_c = $H_2O > HF > NH_3$

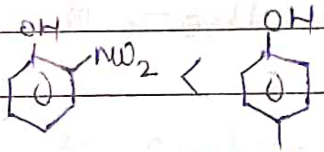
(D) Viscosity ⇒ $H_3PO_4 > H_2SO_4 > H_2O$
6 4 2

(E) All of these.



O in H_2O → 2 -H- bonding
O in Urea → [illegible]

Q→ which of the given option is correct →

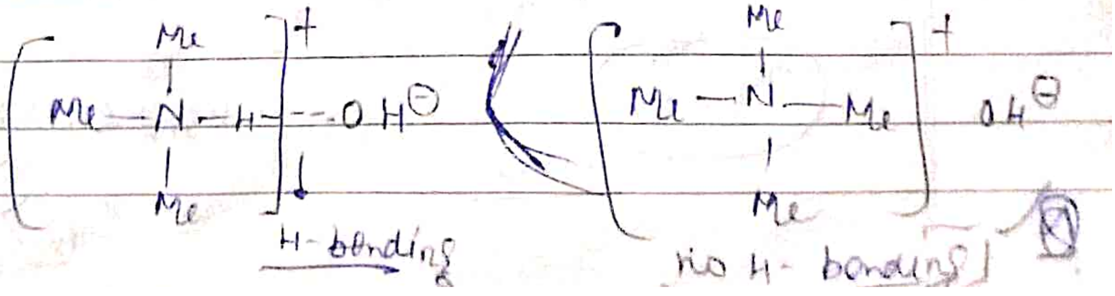
(1) solubility in water. 

(2) ortho nitrophenol can be seperate by p-nitrophenol using steam distilation.

(3) Basic character. $[N(Me)_4]OH^{\ominus} > (N(Me)_3H)^{+}OH^{\ominus}$

④ B.P.: o-salicylaldehyde < p-~~salisldyde~~ salicylaldehyde.

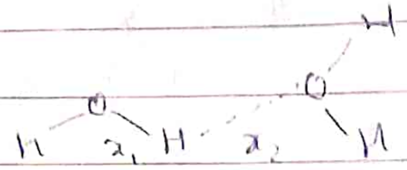
⑤ all.



H-bonding based on bond energy →

① Unsymmetrical H bonding (BE 8 - 12 kJ/mol

when H-atom doesn't lie at mid point w.r.t different 'O' atom of two molecule



$\boxed{x_2 < x_1}$ unsymmetrical

→ Strong dipole - dipole interaction leads to unsymmetrical H - bonding
eg → $H_2O - H_2O$, $H_3PO_4 - H_3PO_4$ etc

② Symmetrical H - Bonding →
when H-atom lies at mid point w.r.t two same electronegative atom.

eg → $[KHF_2] \rightarrow [\underset{(l)}{KF} + \underset{(l)}{H-F}]$

$\underset{x_1}{H - F}$

$F^{\ominus} \underset{x_2}{\longrightarrow} \overset{\delta+}{H} \underset{x_2}{\longrightarrow} F$

$\boxed{x_2 > x_1}$ Ans

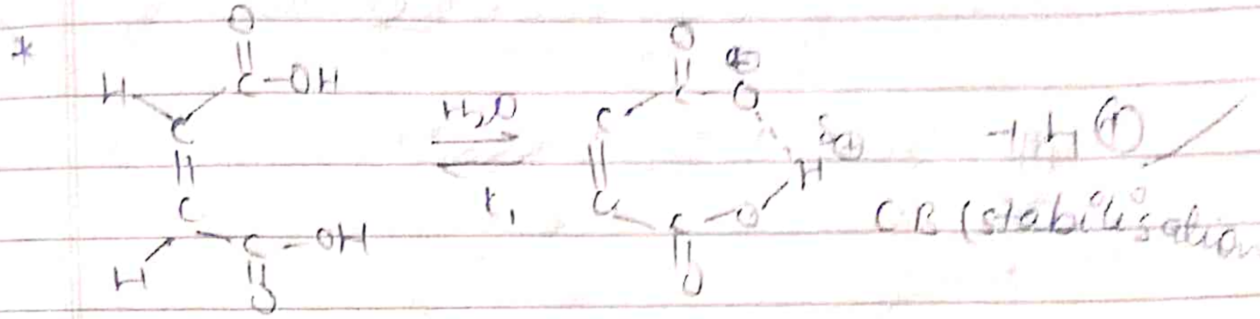
Bond energy

^{x}2BE > 42

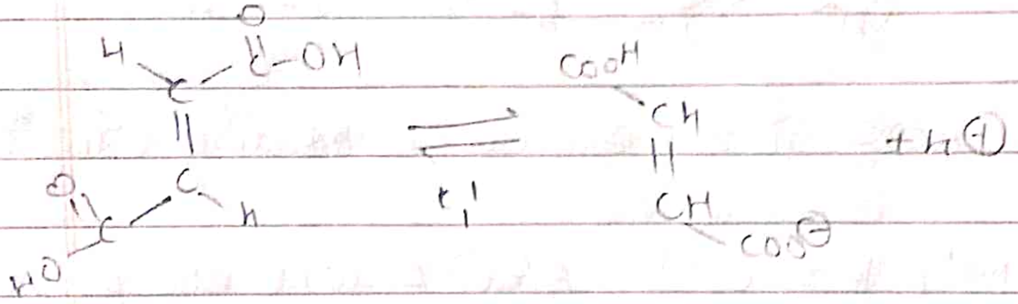
~~Un~~symmetrical - H-bonding observed in ion (H bond EN atom) and dipole (H-bond dipole)

Important compounds involved in H-Bonding →

*



maleic acid



$r_1 > r_1'$

H-Bonding in alkali Bicarbonates →

solid bicarbonates →

$$\frac{r_c}{r_a} = 0.155 - 0.999$$

$$\frac{r_{Li}}{r_a} = \text{very small doesn't exist}$$

✓ Solid bicarbonates exist of Group 1 (e / Li) and $(NH_4)HCO_3$

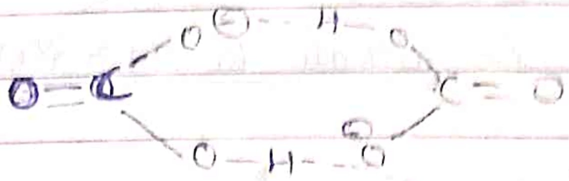
✓ $Ca(HCO_3)_2$ (aq) ✓ $Ca(HCO_3)_2$ (solid) ✗

$MHCO_3(s)$ [M = Na^+ ~~[illegible]~~)

i) $NaHCO_3$

in $HCO_3^{\ominus}$ intermolecular H bonding होता है।

(ii) M^+ (K^+ to Cs^+) ~~Bicar~~ bicarbonate formed dimer in solid via H-bonding.



best lattice → $KHCO_3 > RbHCO_3 > CsHCO_3$

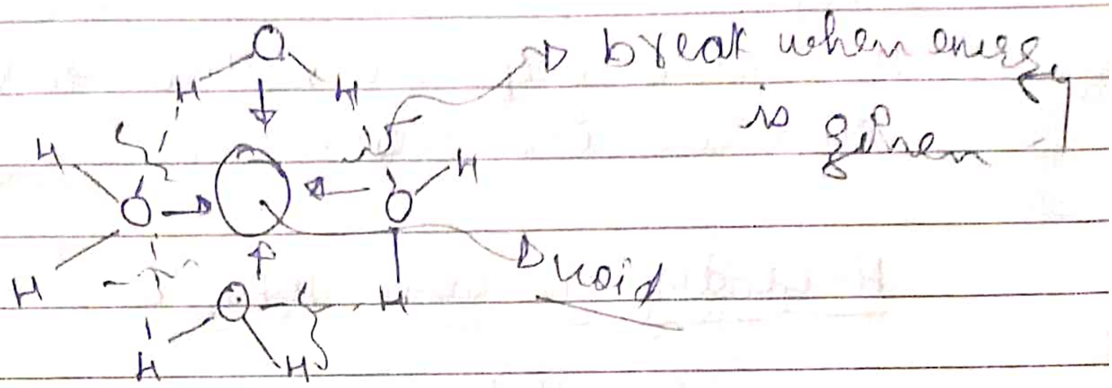
overall order → $NaHCO_3 > KHCO_3 > RbHCO_3 > CsHCO_3$

Solubility → $CsHCO_3 > RbHCO_3 > KHCO_3 > NaHCO_3$

⑰ ICE (solid H_2O) →

~~in~~ so

ice at low temp exist in HCP (hexagonal closed packing) but it changes to CCP at very low temp.



* at 4°c density of water max^m

from 0°c to 4°c → H-bond break and H_2O molecule occupied void ~~sphere~~ space that leads to ↓ in volume and ↑ in density. till 4°c.

* temp > 4°, H_2O molecule gain thermal energy and start expansion that leads to ↑ in volume and ↓ in ρ.

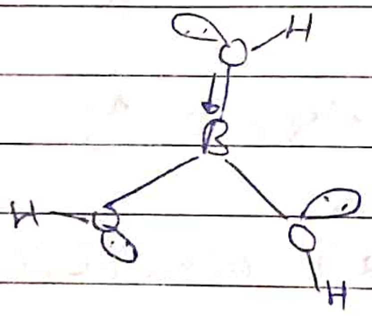
Application of H_2O via H-bond.

(1) H-bonding helps in sticking of ice on wooden stick (ice cream ડાંડી વાળી)

② H-bonding helps in preservation of aquati life

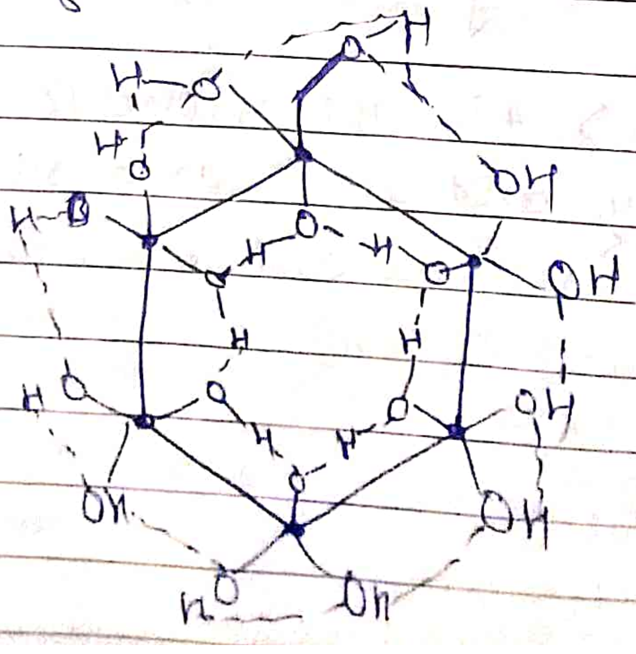
③ H-bonding helps in making thermal & electrical insulator.

H-bonding in solid H_3BO_3 →



3 loan pair & 3 H
~~total~~
6 H-bonding

One loan pair of each involve in back bonding.



→ 12 member ring }
→ 8 member ring }.

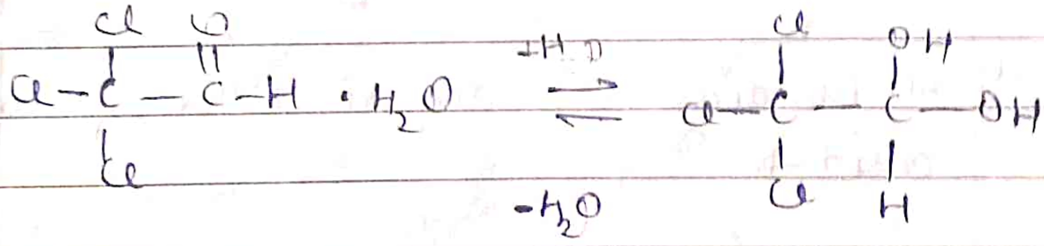
→ No of boron involved in 12 member ring = 0 in $H_3BO_3(s)$

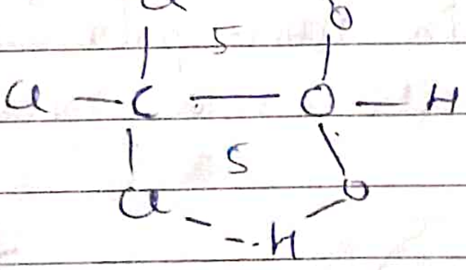
→ No of boron involved in 8 member ring = 2 in $H_3BO_3(s)$

→ No of oxygen atom involved in 12 member ring 6 ✓

→ H-bonding in chloral hydrate →

($CCl_3CHO \cdot H_2O$)





→ vitriol →

oil of vitroil (H_2SO_4) + $Cu(OH)_2$]

$CuSO_4 \cdot 5H_2O$

$CuSO_4 \cdot 5H_2O$

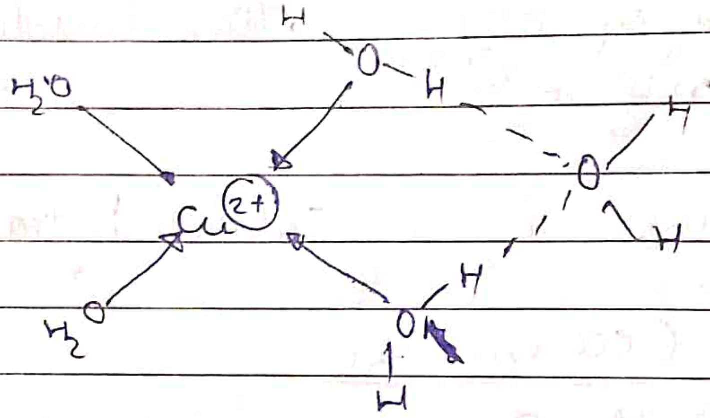
$[Cu(H_2O)_4]SO_4 \cdot H_2O$
$\downarrow$
H-bonding

Green → $FeSO_4 \cdot 7H_2O$

$[Fe(H_2O)_6]SO_4 \cdot H_2O$

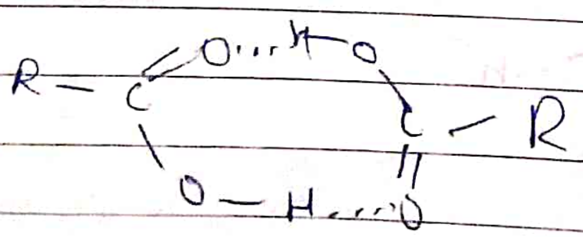
white → $ZnSO_4 \cdot 7H_2O$

$[Zn(H_2O)_6]SO_4 \cdot H_2O$



→ H-bonding in dimerisation of carboxylic acid →

Formic acids | Acetic acid | propanoic acid | dimerarised in non-polar solvent Hence molecular mass double.



then can also dimerise in vapour too

dimerisation

in aq. sol^n they will non dimerize

- H-bonding create a crucial role in formation of DNA & RNA

- **Vanderwaal forces** →

weak forces (B.E < 8 KJ/mole)

→ Dipole - Dipole (Keesom forces)
polar - polar molecule.
eg → $\underset{\delta+}{H}-\underset{\delta-}{Cl} \cdots \underset{\delta+}{H}-\underset{\delta-}{Cl}$

Interaction energy $\propto \frac{1}{r^3} = \frac{K|\mu_1||\mu_2|}{r^3}$

Melting point

① covalent (3D) (solids)
eg → Black phosphorous
Diamond | SiO_2)
SiC | $(BN)_x$ (3D)
in covalent →
$\boxed{MP \propto B.E}$
↓
use of
compound are
covalent

(ii) ionic solid → F^- of s block are ionic solid except BeF_3.

→ Cl^- | Br^- | I^- | of group I except Li

→ O^{2-} | H^- of s block except Be^{2+} | Mg^{2+}

③ ionic solid affected due to polarisation →
→ LiX / MX_2 (X → Cl | Br | I)

④ Molecular solids →
eg → H_2O | HF | CO_2 | P_4 white | CS_2 etc
all vanderwaal forces.

order of MP →
→ if ~~they~~ type of solid is different →

$$\begin{array}{ccccc} \text{Diamond} & > & \text{NaCl} & > & \text{white phosphorous} \\ \downarrow & & \downarrow & & \downarrow \\ \text{(covalent 3D)} & & \text{(ionic)} & & \text{(molecular solids)} \end{array}$$

①

Q → ① Black phosphorous (3D- phosphorous covalent) ② CsCl ③ Dry ice ④ ice

ionic (② CsCl)
vanderwaal (③ Dry ice)
hydrogen (④ ice)

1>2>4>3>

$\boxed{\text{Over all order} \rightarrow \underline{\underline{1>2>3>4}} \text{ of MP}}$

D

Q →
$\overset{+}{Li}\overset{-}{F} > \overset{+}{Na}\overset{-}{F} > \overset{+}{K}\overset{-}{F} > \overset{+}{Rb}\overset{-}{F} > \overset{+}{Cs}\overset{-}{F}$ (all ionic)

if same then look for Lattice energy

$\underline{LE \propto MP}$ $\quad \frac{kq_1q_2}{r_a + r}$ ↑

ionic solid affected due to polarisation

ionic

Q → LiCl NaCl KCl RbCl CsCl

use MP ∝ B.E.

MP → NaCl > KCl > RbCl > CsCl > LiCl

Q → LiBr NaBr KBr RbBr CsBr

ionic

NaBr > KBr > RbBr > CsBr > LiBr

affected due to polarisation

Q → $\boxed{MgF_2} > MgCl_2 > MgBr_2 > MgI_2$ → affected due to polarisation

ionic

MP ∝ L.E.

Q → $AlF_3 > MgF_2 > NaF_2 > SiF_4$

ionic ionic ionic molecular.

Q → SiC > AlN > MgO > NaF (all ionic]

covalent 3D