p- Block

p-block elements ⇒
an electronic configration it last electron enter in p- subshall. The element consider in p-block element.
The genral electronic configration of p-block element is ns^2 or np^{1-6}

p- block classified in 6- Groups :-
which are representete in period table by Group. 13, 14, 15, 16, 17 and 18.

Group - 13 → B, Al, Ga, In, Ti

B - 5, Al - 13, Ga - 31, In - 49, Ti - 81

Occures
B, $Na_2B_4O_7 ; 10H_2O$
Al, $Al_2O_3, 2H_2O$, Na_3AlF_6

Ga and In and Ti are occure in mature in earth crust in native state.

Properties of Group - 13

5	Be	[He]	$2s^2 2p^1$
13	Al	[Ne]	$3s^2 3p^1$
31	Ga	[Ar]	$4s^2 4p^1$
49	In	[Kr]	$5s^2 5p^1$
81	Tl	[Xe]	$6s^2 6p^1$

Atomic size increase from B to Ti
ionosion enthelpy decrease from B to Ti
metalic charector B to Ti metelic charector increase.

Imp:

Use for Making alay:-

Alnuko- steal + Nikil + Alimmynium + Cobalt

paralumine - 95% Al + Cu + Mg + Mn

Chemical properties:-

React with AiR

Only B and Al react with Oxygen and Nytrogen of air other metal do not react.

$B + Air \longrightarrow B_2O_3 + BN$ (Boron nytric)

$Al + Air \longrightarrow Al_2O_3 + AlN$

React with water:-

Accept Al other member of Group-13 do not react with water in cold and that condition Al the can react with hot water.
In the present of mercury. The reactivity in crease.

$$2Al + 6H_2O \longrightarrow 2Al(OH)_3 + 3H_2\uparrow$$

Hydrides of Boron (B) family :-

BH_3, AlH_3, GaH_3, InH_3, TlH_3

The hydrides of B family cannot be prepared by Direct combination of H and B family element.

for making Hydrides of B family special Method we will apply.

Hydrides of B →

When B formed compound with H atom. Know as Boron hydride.

1- B_nH_{n+4}

Nedo Borane

B_2H_6

B_3H_7

$n = 2, 3, 4 \ldots$

2- B_nH_{n+6}

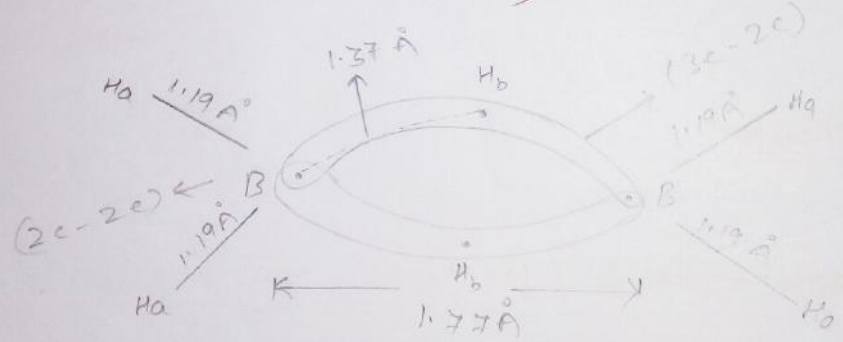
Archano Borane

B_4H_{10}

B_5H_{11}

$n = 4, 5, 6 \ldots$

Nedo Di Borane (B_2H_6) :-



$B_2H_6 \rightarrow BH_3$

$x = \frac{1}{2}(3+3)$

$x = 3$

sp^2 Hybridization.

where H_b - are breezing hydrozen

H_a - are known as ferminal Hydrozen.

Method on preparation Nedo Di Borane:—

1— $2BCl_3 + 6H_2 \xrightarrow{\text{Electricity}} B_2H_6 + HCl$

Lebrotry Method:-

$2NaBH_4 + I_2 \longrightarrow B_2H_6 + 2NaI + H_2\uparrow$

(Sodium Borane Hydride)

③ Industrial Method:—

$2BF_3 + 6NaH \xrightarrow{\Delta} B_2H_6 + 6NaF$

4- Physical Properties:-

It is a colourless Gas stable at low temp. having sweet order.

It is extrimly toxic. is bowling temperture −165°C temp.

5- Chemical Properties:—

i) Action of heat ⇒ when di Boran is heated at different condition different products are formed.

i) Heat at low Temp—

$B_2H_6 \xrightarrow{\Delta \text{ (low temp)}}$ No Rxn

ii) Heat at Modreat Temp (100°+)

$B_2H_6 \xrightarrow{\Delta\ (100°C+)}$ Higher borane are form.

$2B_2H_6 \xrightarrow{\Delta} B_4H_8 + 2H_2\uparrow$

$5B_2H_6 \xrightarrow{\Delta} 2B_5H_{11} + 4H_2\uparrow$

(iii) B_2H_6 heated in a red heated Tube:-

$B_2H_6 \xrightarrow{\text{(Red heated Tube)}} 2B + 3H_2\uparrow$

Reaction with Oxygen (O_2) →

$$B_2H_6 + 3O_2 \longrightarrow B_2O_3 + 3H_2O$$

Reaction with water :-

$$B_2H_6 + 6H_2O \longrightarrow 2H_3BO_3 + 6H_2\uparrow$$

(Orthoboric acid)

+ Rxn with Cl_2

$$B_2H_6 + 3Cl_2 \longrightarrow BCl_3 + 3HCl$$

Imp $2LiH + B_2H_6 \xrightarrow{\text{Ether}} 2LiBH_4$

(Lithium Boranhydride)

$$2NaH + B_2H_6 \longrightarrow 2NaNH_3$$

Most imp Reaction B_2H_6 with Amonia -

Amonia React with B_2H_6 in following 3 cases.

1- At Low Temp

2- At 200° C

3 - At higher Temp when amonia is in axes .

i- At LOW Temp -

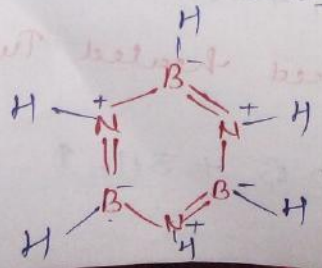
$$B_2H_6 + 2NH_3 \xrightarrow{\text{Low Temp}} B_2H_6 \cdot 2NH_3$$

$$B_2H_6 + 2NH_3 \xrightarrow{\text{Low Temp}} 2[H_3B \leftarrow NH_3]$$

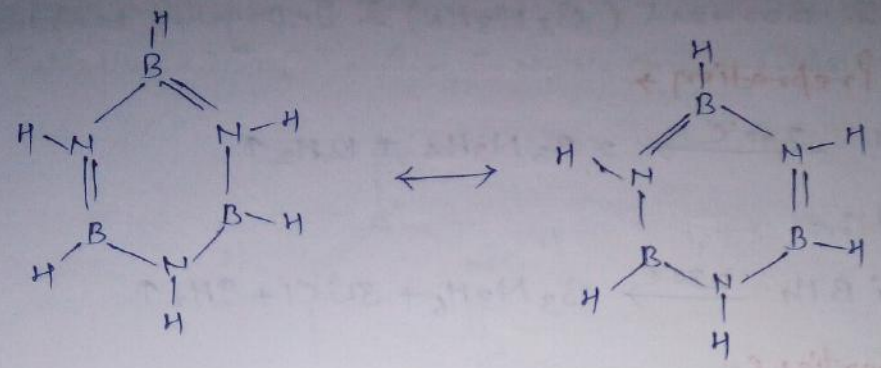
$$2[H_3B^- — \overset{+}{N}H_3]$$

2- At 200° C Temp -

$$3B_2H_6 + 6NH_3 \xrightarrow{200°C} 2B_3N_3H_6 + 12H_2\uparrow$$



Borazene.



(Borazene Inorgenic Benzene)

3- At high Temp -

$$B_2H_6 + NH_3 \xrightarrow{\text{high Temp}} (BH)_x + H_2\uparrow$$

(axess) (Boraz nydrite)

Uses of Di borane (B_2H_6)

i) it is use for the method of prepration of Alchohal form Alkine.

(Tetera hydro Bromine)

$$>C=C< \xrightarrow[H_2O_2 - OH^-]{BH_3 - THF} >C(H)-C(H)(OH)<$$

2- it is use as a Caltist for the Pollimerization Reaction.

3- it is use as fuel.

4- it is use as a Reducing agent for many Orgenic Reaction.

Borazene & Borazel ($B_3N_3H_6$) & Inorganic benzene

* Method of Preparation →

$$3B_2H_6 + 6NH_3 \xrightarrow{200^\circ C} 2B_3N_3H_6 + 12H_2\uparrow$$

* Lab Method :-

$$3NH_4Cl + 3LiBH_4 \xrightarrow{230^\circ C} B_3N_3H_6 + 3LiCl + 9H_2\uparrow$$

* Physical Properties :-

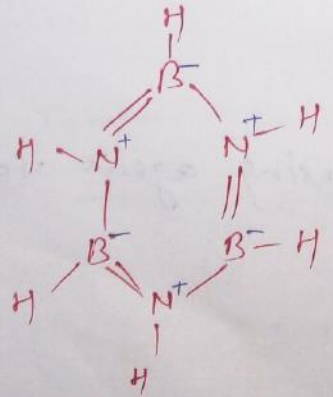
It is a colourless mobile volityle liquid. it boiling point is 68.5°C it Physical property atmost simmiler to benzene but chemically both are different.

Benzene	Borazene
Its Molicuter weight - 78gm	80gm
Boiling - 80°C	65°C
Melting - +6	-58

Chemical Properties :-

(- Reaction with HCl →

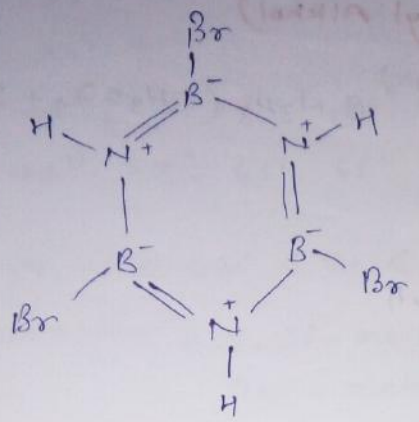
$$B_3N_3H_6 + 3HCl \xrightarrow{\Delta} B_3N_3H_3Cl_3 + 3H_2\uparrow$$



1,3,5 Trichloro borazene.

2- Rxn with Br (Bromine)

$B_3N_3H_6 + 3Br_2 \xrightarrow{\Delta} B_3N_3H_3Br_3 + 3HBr$



1, 3, 5 Tribromo borazene.

3- Rxn with water ⇒

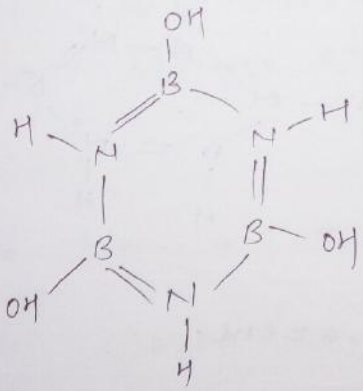
Borazene react with water in 2 different condition.

1- Under Room Temperature

2- Greater then Room Temperature.

4 Room Temp

$B_3N_3H_6 + 3H_2O \longrightarrow B_3N_3H_3(OH)_3 + 3H_2\uparrow$



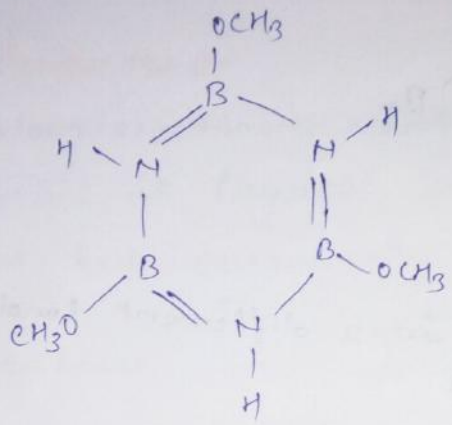
1, 3, 5. Hydroxy Borazene.

Greater then Room Temp -

$$B_3N_3H_6 + 9H_2O \xrightarrow{\Delta} 3H_3BO_3 + 3NH_3 + 3H_2\uparrow$$

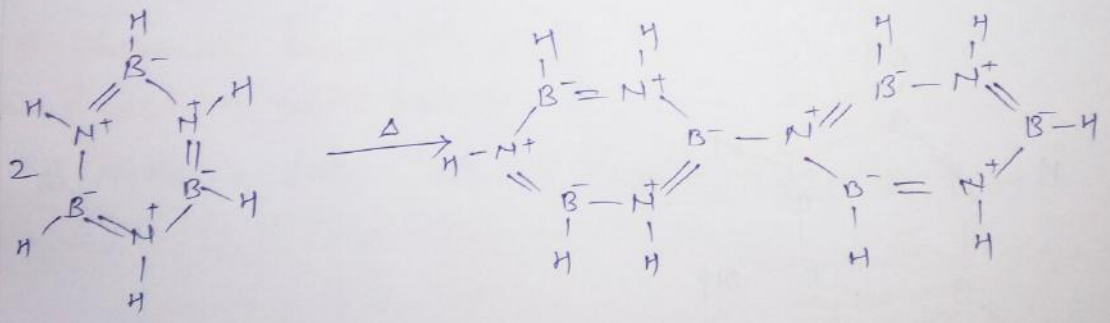
Reaction with CH_3OH (Methyl Alkhol)

$$B_3N_3H_6 + 3CH_3OH \xrightarrow{\Delta\ (Pyrolysis)} B_3N_3H_3(CH_3O)_3 + 3H_2\uparrow$$



1, 3, 5, Methy Oxy Tri Borazene.

* Polymerisation ⇒



Di Borazene.

Group - 14

$_{6}C$ [He] $2s^2, 2p^2$

$_{14}Si$ [Ne] $3s^2, 3p^2$

$_{32}Ge$ [Ar] $4s^2, 4p^2$

$_{50}Sn$ [Kr] $4d^{10}, 4d^{10}, 5s^2, 5p^2$

$_{82}Pb$ [Xe] $4f^{14}, 5d^{10}, 6s^2, 6p^2$

Atomic Radii - $C < Si < Ge < Sn < Pb$

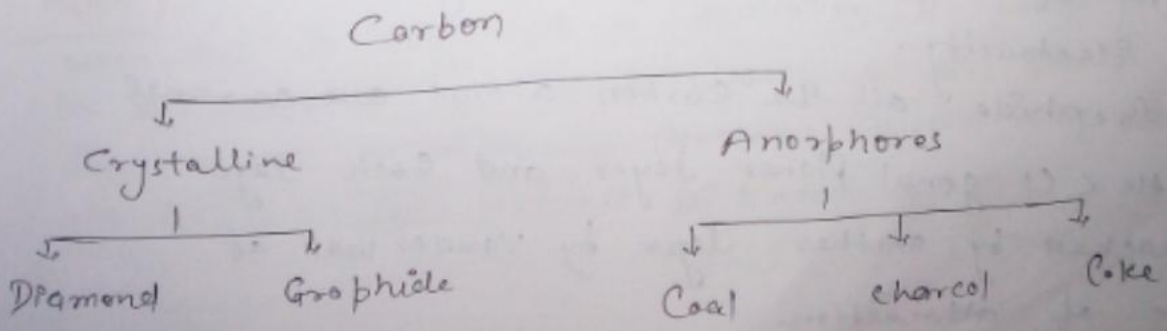
Metalic character → C, Si - non metal
Ge - metaloid
Pb, Sn - metal

inoisation enthelpy :- $C > Si > Ge > Pb > Sn$

Allotrops of Carbon →
when an Element occures in nature in different Puttern in any metal due to which its physically change, Know as Alltrop of Each other Carbon has 2 Types of Allotrop on the pasis of arrangement of the Element.

① Crystalline ② - Amorphores

These Two from are further elansified.



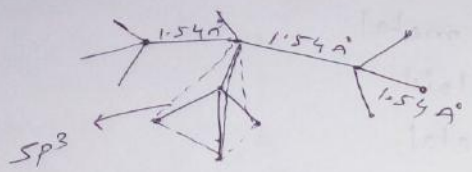
Diamond ⇒

1- It is the Purest form of carbon. It is the hardest substent.

2- it is colourless and Transparent.

3- In industry if is affenly black.

4- In diamound all the carbon atom arrange it sell due to catination Property. Each carbon has sp^3 hybridization.



Energy c to c 1.54 Å.

Due to no unpaired e^- Persent on carbon atom diamond is bed conductor of heat and Electricity.

Uses of Diamond ⇒

1- it is use in the Glass cuter.

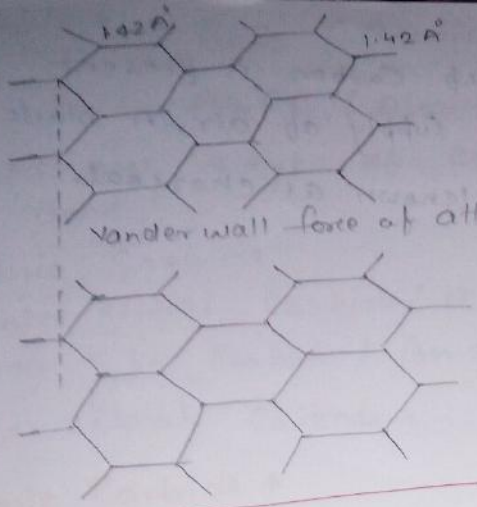
2- it is use in grinder for hard metlaer.

3- it is use in gem stone.

GREPHIDE ⇒

in the grephide each carbon staisfied sp^2 hybridi zation. as well as present 1 unpaired $e^\ominus$ due to Present of unpaired $e^\ominus$ if is a good Conductor of Electricity.

In grephide all the carbon atoms are arrangl in Hexagonal Planer layer and each layer attracked by another layer by vander wall of force of attraction.



C to C bond lenght 1.42 Å

layer to layer distance 3.35 Å

Graphite $\xrightarrow[50,000\ atm]{1600^\circ C}$ Diamond

Uses of Graphite :-

1- Use for making led pencil.
2- Use for making electrod.
3- Use as moderater in nuclear Reactor.
4- Use as a lubricant in machine.

Coal :-

it is the coud from of carbon. it has been formed in nature as a result of slow decomposition of vegitable mettuse under the influence of heat. Pressure and limmiting supply of air.

Coke :-

when coal is subjected to distilation by heating in the ubsent of air it looses valitile cosnsti-tuents such as Amonia, Benzene, Phinol and other the residie left behind is known as coke.

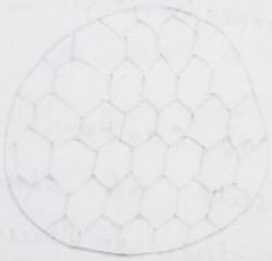
* Charcoal →

Such type of substent in which carbon is present in which if burn in limmiting supply of air, A black residue is obtened. which is known as charcoal.

Ex - wood charcoal
Sugar charcoal.
Salidose charcoal
Coconut charcoal.

Note

Besides these 2 carbon occure in nature in a spherical from known as fullerenes.
In fullerenes the carbon atom arranged in 5 and 6 atom ring. Its molicular formula is C_{60}.



C_{60}

12 - 5 member Ring
20 - 6 member Ring.

most important Carbide →

Such type of binary Compound in which Carbon atom combined with more Electroc with more Electroc Positive → Element (metal)

Example → CaC_2

Example 2 BeC_2 (Berilum Carbide)

Al_4C_3 (Alminum Carbide)

There are 4 type of Carbide on the basic of nature of Bond.

1- Ionic Carbide
2- Interstitial Carbide / metalic Carbide.
3- Iron Type Carbide / Border line Carbide.
4- Co-velent Carbide.

Ionic Carbide →

Such type of Carbide in which highly electro positive element combined with Carbon by ionic bond, known as ionic Carbide. Such Type of Carbide are formed by Group- I and Group- II element.

Ex - CaC_2

Be_2C

Li_3C_2

INTERSTITIAL CARBIDE →

Such Type of Carbide in which Carbon atom is Trapped by the Interstitial side of the metalic crystaline solid.

* Iron Type Carbide →

In this Type of Carbide Carbon present at the octahydeil site of the iron atom.

Co-velent carbide :

Such type of carbide in which carbon attacne with Si and B by co-velent bond known as co-velent carbide.

Ex- SiC

Some Type of carbide :-

1) CaC_2 (calcium carbide)

method of Prepration →

$$Ca_3(PO_4)_2 + 14C \xrightarrow{\Delta} 3CaC_2 + 2P + 8CO\uparrow$$

Industrial method →

$$CaO + 3C \longrightarrow CaC_2 + 3CO\uparrow$$

Physical Property :-

It is an ionic carbide occure in nature in crystline from. it has grey colour.

Chemical property :-

i- Rxn with water :-

$$CaC_2 + 2H_2O \longrightarrow \underset{\text{(acetline gas)}}{C_2H_2} + Ca(OH)_2$$

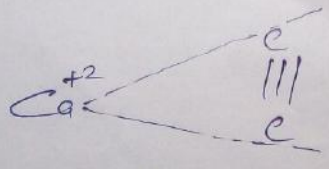
ii) Rxn with Nytrozen →

$$CaC_2 + N_2 \xrightarrow{\Delta} CaCN_2 + C$$

Nitroline
(Calciume synamide)

$CaCN_2$ is a Furly lizer. (उर्वरक)

* Structure →



↓

Ionic Bond.

ii) Aluminium Carbide (Al_4C_3) →
Method of Prepration ⇒

$4Al + 3C \xrightarrow{\Delta} Al_4C_3$

$2Al_2O_3 + 4C \longrightarrow Al_4C_3 + 6CO\uparrow$

Physical Property :-
It is yellow crystline solid. It is an ionic carbide.

chemical Property :-
Rxn with water.

$Al_4C_3 + 12H_2O \xrightarrow{\Delta} 3CH_4 + 12Al(OH)_3$

Rxn with O_2 ⇒
$Al_4C_3 + 6O_2 \longrightarrow 2Al_2O_3 + 3CO_2\uparrow$
Its Regular structure is Hexagen.

iii) SiC (Silicon carbide) (Carborendom)
Method of Prepration :-

I- $SiO_2 + 3C \longrightarrow SiC + 2CO\uparrow$

II- $2Si + C_2H_2 \longrightarrow 2SiC + H_2\uparrow$

Physical Properties :-
It is a colourless crysteline solid. It is nearly hard as diamond. It is insoluble in water and Alcohol.

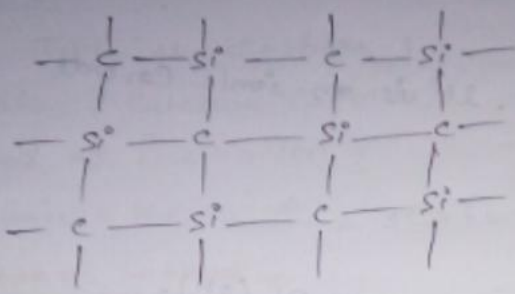
= Chemical Properties :-

i- $SiC + O_2 \xrightarrow{1000^\circ C} SiO_2 + CO\uparrow$

$SiC + 2Cl_2 \xrightarrow{100^\circ C} SiCl_4 + C$

Structure →

SiC is co-velent crystline solid. Each Si is surrounded by Carbon and each Carbon is surrounded by Si due to which. It has planer structure.



Cholore fluro Carbon (C.F.C) →

These are the compound which can be obtened by replaling Hydrogen atoms from hydro carbon by helozen atom.

Ex-

1- CCl_2F_2 di chloro di flozomethane

2- $CF_2 = CF_2$ Tetsra fluro ethane

3- CCl_3F tri chloro fluro methane

4- $CHClF_2$ chloro di floro methane

Method of Preparation →

1- $CCl_4 + 2HF \xrightarrow{\Delta} CCl_2F_2 + 2HCl$

2- $CHCl_3 + 2HF \xrightarrow{\Delta} CHF_2Cl + 2HCl$

3- $CHF_2Cl \xrightarrow{\Delta} CF_2 = CF_2 + 2HCl$

4- $CH_4 + 2F_2 \longrightarrow CH_2F_2 + 2HF$

$CH_2F_2 + 2Cl_2 \longrightarrow CCl_2F_2 + 2HCl$

$3CCl_4 + 2SbF_3 \xrightarrow{\Delta} CCl_2F_2 + SbCl_3$

(antimony trifloride)

Propties of (C.F.C.) →

C.F.C is more stable then helo carbon. C.F.C do not react with any acid, base any chemical reason.

C.F.C are non-Toxic, Colourless and non-Inflemible.

$CF_2=CF_2$ Use for making Teflon

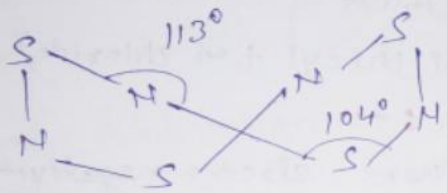
CCl_2F_2 is use in Refriguanfor and A.C. (air Conclinstor)

it is use for making insulating Cable.

it is Solver of D.D.T. and other Insectiside.

Tetra Salfher tetra Nytride (S_4N_4)

Structure →



method of Preparation →

I $6S_2Cl_2 + 16NH_3 \xrightarrow{CCl_4} S_4N_4 + S_8 + 12NH_4Cl$

II $10S + 4NH_3 \longrightarrow S_4N_4 + 6H_2S$

Physical Properties →

it is an orange yellow crystline solid at is insolivile in water but highly soluvite in organic solvent it is an explosive.

(विस्फोटक)

at is dia megnative in Nature.

chemical properties ⇒

i) Action of heat ⇒

at low temp S_4N_4 is stable but at high temp. it will give 2 molecule of S_2N_2.

$$S_4N_4 \xrightarrow{\Delta} 2S_2N_2$$

ii) Reduction ⇒

$$S_4N_4 + 4[H] \xrightarrow{Sn+HCl} S_4(NH)_4$$

(Tetrea sulphate / Tetrea amide)

Oxidation Reaction :-

$$S_4N_4 + 6Cl_2 \longrightarrow 4(SN)_3Cl_3$$

(Tri thizyl tri chloride)

Inter helozen Compound :-

Due to difference in there electro negativity 2 or more then 2 different hetozen combined ~~together~~ and ~~formed~~ molecule which is known as Inter helozen Compound. There are 4 Types of Inter hetozen compound occure in Nature.

1- AX Type

2- AX_3 Type

3- AX_5 Type

4- AX_7 type

where X is more electro negative hetozen atom then A.

Example and structure of AX_3

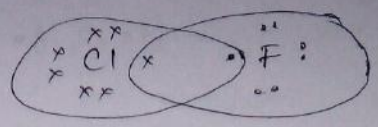
ClF_3

BrF_3

IF_3

ICl_3

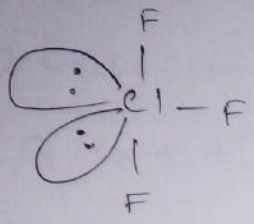
ClF_3



$$\chi = \frac{1}{2}[7+3]$$

$$= 5$$

$$= sp^3 d$$



method of Prepration :-

i) By Direct combination of Helogen.

$$Cl_2 + 3F_2 \xrightarrow[Ni]{\Delta} 2ClF_3$$

$$Br_2 + 3F_2 \xrightarrow{\Delta} 2BrF_3$$

② it is prepared by the help of Ax type of Inter Helogen Compound.

$$ClF + F_2 \xrightarrow{\Delta} ClF_3$$

$$BrF + F_2 \xrightarrow{\Delta} BrF_3$$

Physical Properties :-

These are Colouless gases on Condensation. They will give Pale green liquid. They are moderately soluble in water.

* Chemical properties :-

* method of Prepration :-

By the help of direct combination of I_2 and F_2.

IF_7 cannot be prepared for the prepration of IF_7, we will use lower member of inter halogen compound.

$$IF_5 + F_2 \longrightarrow IF_7 .$$