

29/8/23

Organic Chemistry

classmate

Date _____
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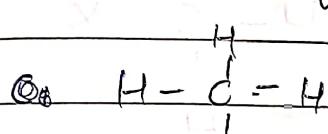
Chapter - 6

Alkyl Halide & Halo Aromatic

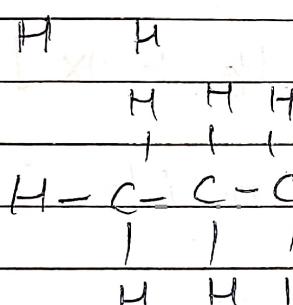
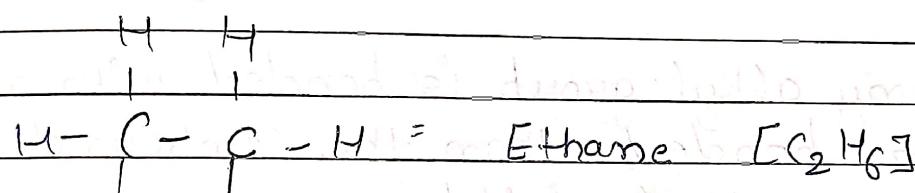
Alkane - • Hydrocarbon [C-C]

• General formula [C_nH_{2n+2}]

• Suffix word "AN"



= Meth + An H = Methane

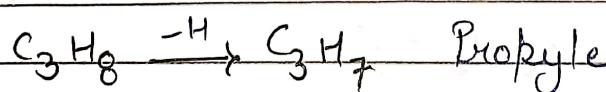
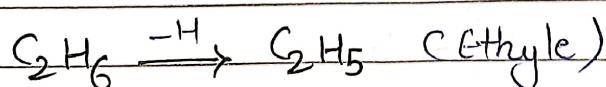
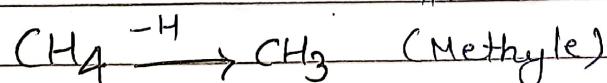


Propane [C₃H₈]

Alkyl - Alkane $\xrightarrow{-\text{H}}$ Alkyl

* C_nH_{2n+1}

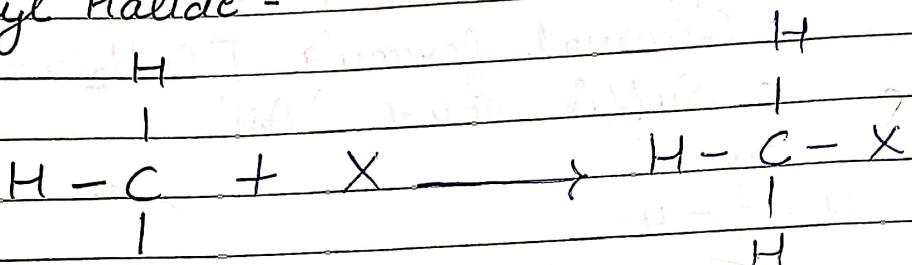
* "YLE" suffix.



Halogen - F, Cl, Br, I

{ Halo + gen
(Salt + formation) }

Alkyl Halide -



[Methyl Halide]

= When any alkyl group is bonded with any Halogen than the compound is known as Alkyl Halide.

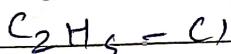
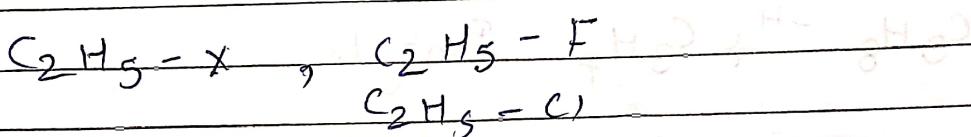
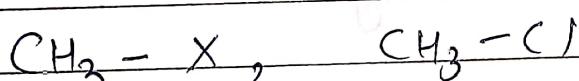
general formula - $[\text{C}_n\text{H}_{2n+1}\text{X}]$

General structure of Alkyl halide is $[\text{R-X}]$

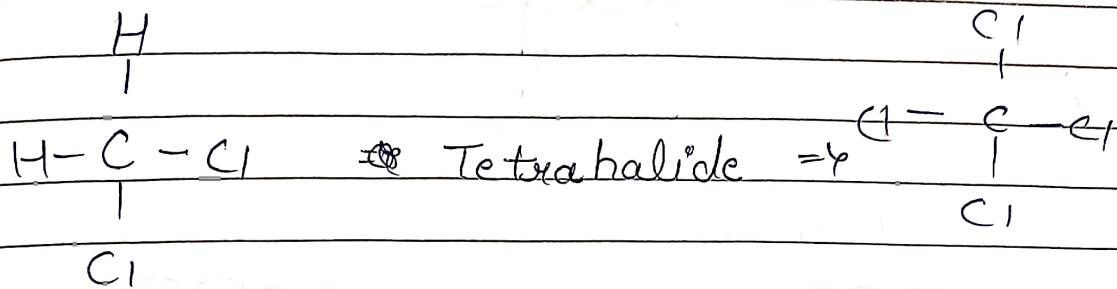
Classification of Alkyl Halide -

(i) ON the basis of No. of Halogens -

Mono halide - [Unihalide]



Dihalide.

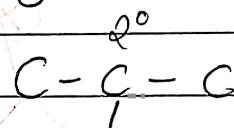


(ii)* On the basis of position of Halogen -

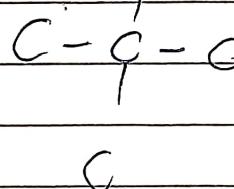
Primary Halide / 1° Halide



Secondary Halide / 2° Halide



Tertiary Halide / 3° Halide



(iii) On the basis of Hybridisation -

Hybridisation

On the basis
of sp^3 Hybrid.

On the basis
of sp^2 Hybrid.

1. Alkyl Halide

$sp^3 \ sp^3 \ sp^3$



1. Vinyl Halide



2. Acyl Halide

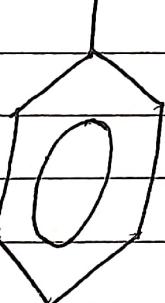
Halo Aromatic

2. Alkyl Halide

$sp^2 \ sp^2 \ sp^3$



3. Benzylic Halide

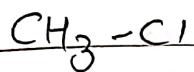


Common name \neq IUPAC name of $R - X$.

$R - X = C/N :-$ Alkyl Halide

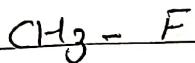
I/N :- Halo Alkane

E.g.



C/N :- Methyl Chloride

I/N :- chloro Methane



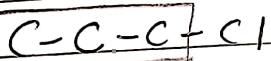
C/N :- Methyl chloride

I/N :- chloro Methane.



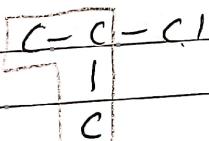
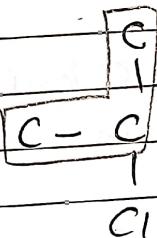
C/N :- Ethyl chloride

I/N :- chloro Ethane



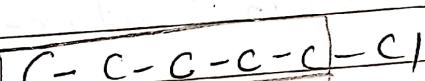
C/N :- n-propyl chloride

I/N :- 1-chloro Propane



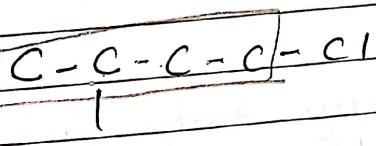
C/N :- Iso Propyl chloride

I/N :- 2-chloro Propane



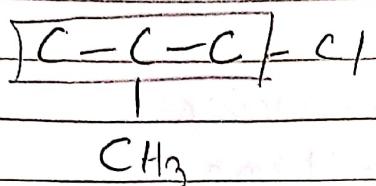
C/N :- n-Pentyl chloride

I/N :- 1-chloro Pentane

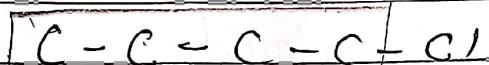


C/N :- Iso Pentyl chloride

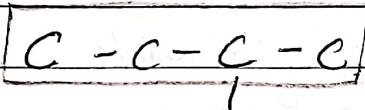
I/N :- 1-chloro-3-Methyl Butane



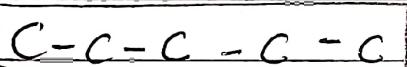
I/N = 1-Chloro 2-Methyl Propane
 C/N = Iso Butyl chloride



C/N = n-Butyl chloride
 I/N = 1-Chloro Butane

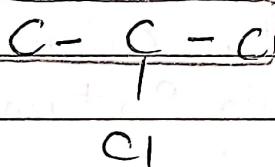


C1 C/N = Secondary Butyl chloride
 I/N = 2-Chloro Butane

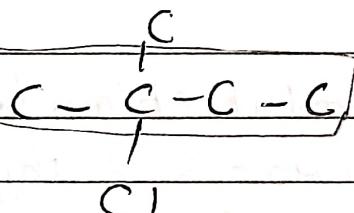


C1

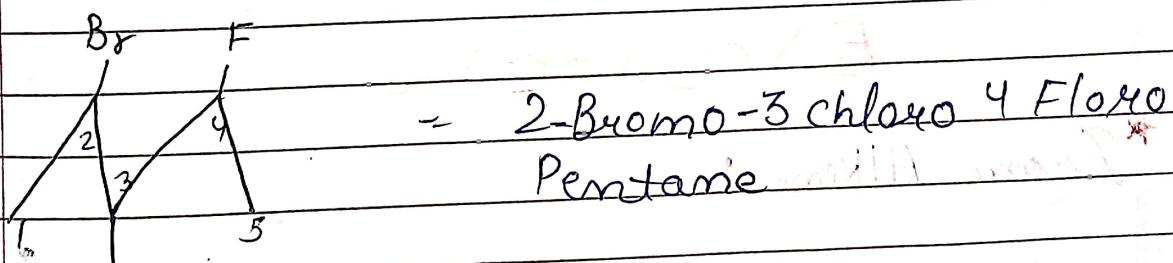
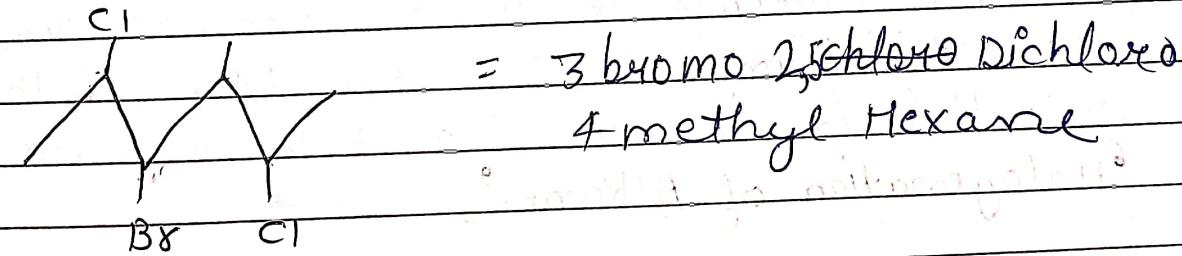
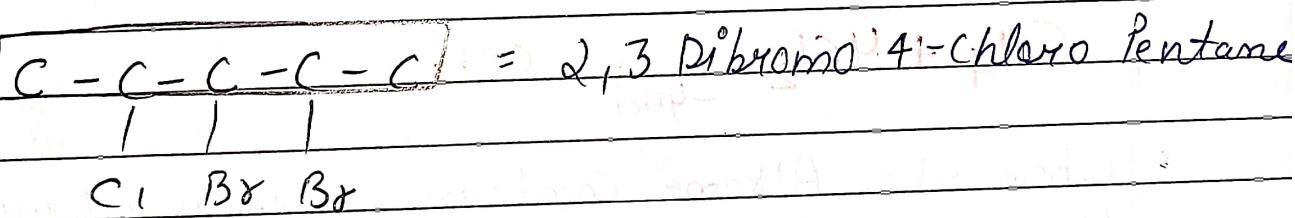
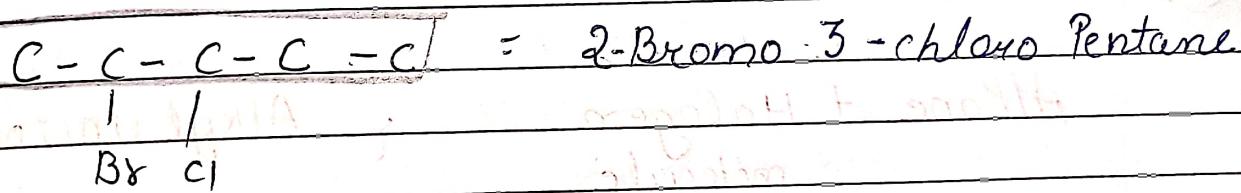
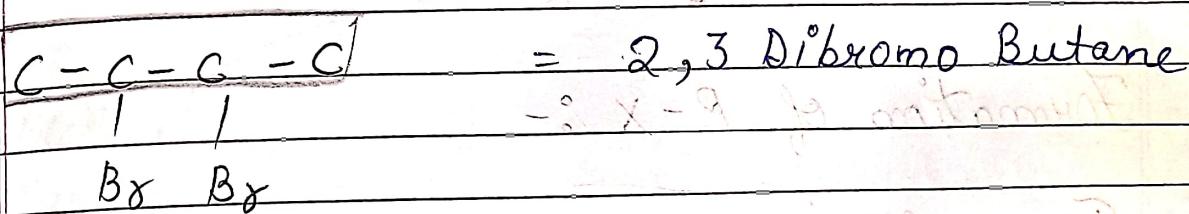
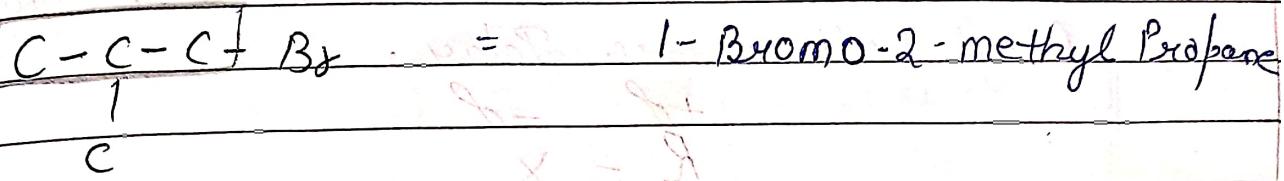
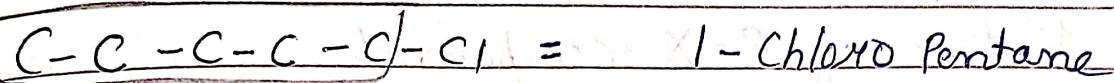
C/N = Secondary Pentyl chloride
 I/N = 2-Chloro Pentane



C/N = Tertiary 1-Butyl chloride
 I/N = 2-Chloro-2-Methyl Propane

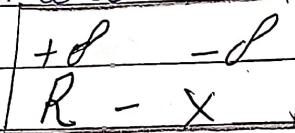


C/N = Tertiary Pentyl Chloride
 I/N = 2-Chloro-2-Methyl Butane



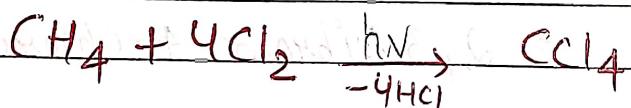
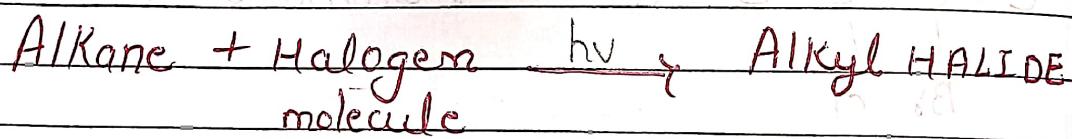
Nature of R-X compound

In the R-X compound Alkyl group have +ve charge and Halogen atom have -ve charge so Alkyl Halides are Polar.

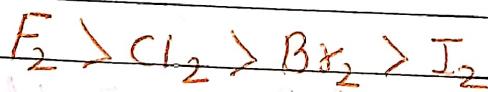


Formation of R-X :-

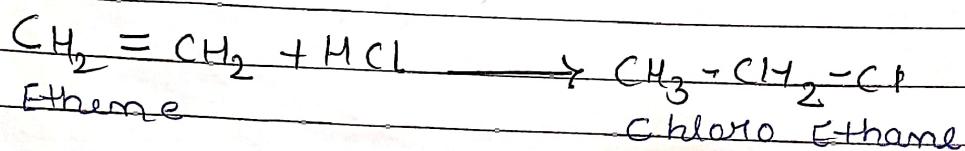
(I) From Alkane :-



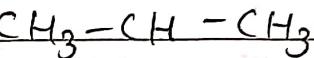
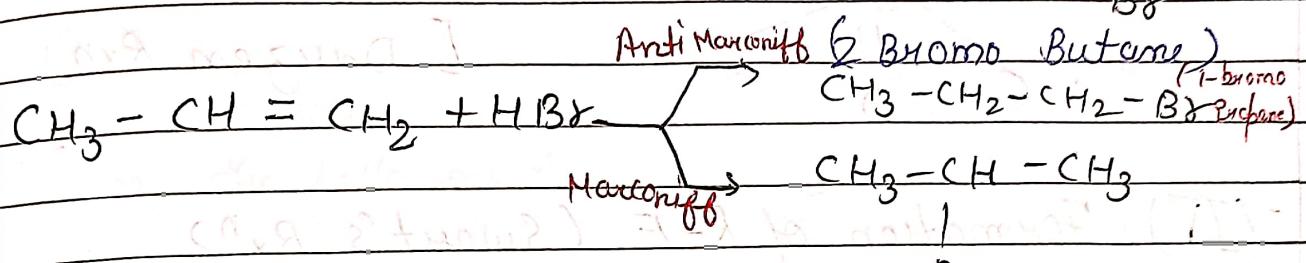
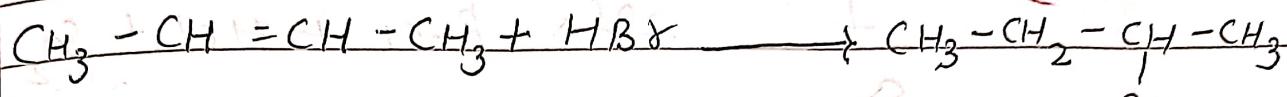
When the Alkane compound reacts with Halogen Molecule in the presence of Sunlight than the form of Alkyl Halide. In this reaction Halogen is add so it is known as 'Halogenation of Alkane'.



(II) From Alkene :-



(2-Bromo Butane)



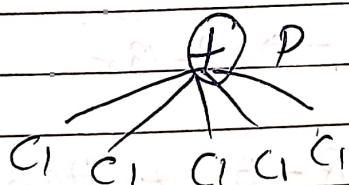
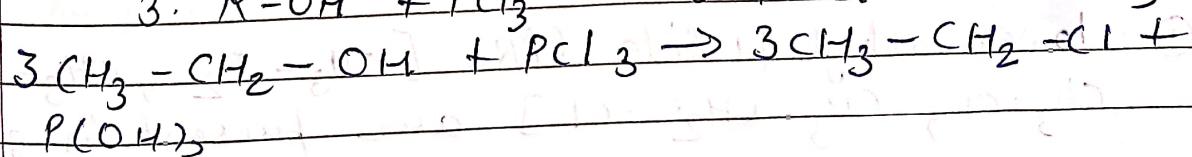
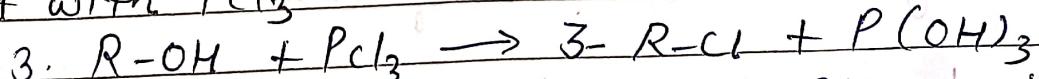
Br (2-Bromo

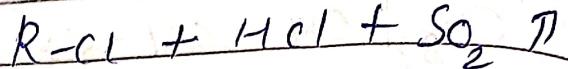
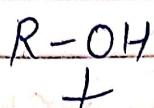
Propane)

Acc^r to markonikoff the halogen will attack on the carbon atom which have ↓ (H) atom.

But acc^r to anti markonikoff if Rxⁿ is complete in the presence of benzene peroxide then they form 1-halo alkene, but this effect is only shown by (HBr)

(II) From Alcohol

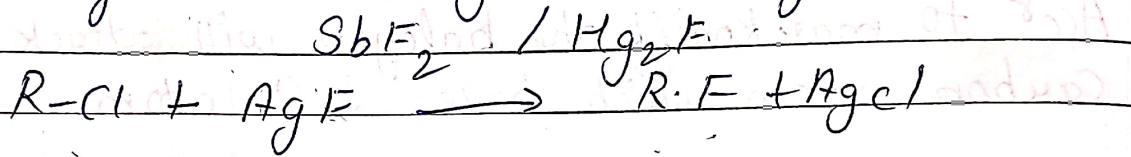
(A) React with PCl₅(B) React with PCl₃(C) React with SOCl₂ (Thionyl chloride)



[Dowzen Rxn]

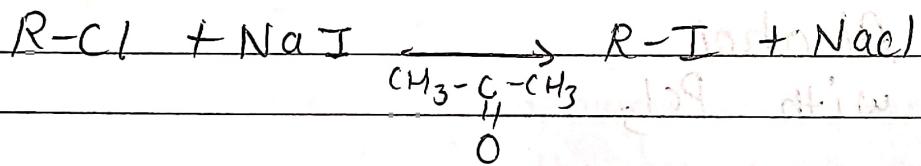
(IV) Formation of R-F (Swant's Rxn)

Alkyl Halide + AgF \rightarrow Alkyl Fluoride



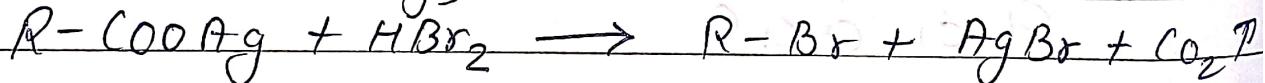
(V) Formation of R-I (Finkelstein Rxn)

Alkyl Halide + NaI \rightarrow Alkyl Iodine
in dry acetone



(VI) Formation of R-Br (Hunsdiecker Rxn)

Fatty acid of Ag + Br₂ \rightarrow R-Br



Physical Properties of R-X

① lower alkyl Halide like [CH₃-F₂, CH₃-Br₂, CH₃-Cl, CH₃-CH₂-Cl] are present in gaseous form

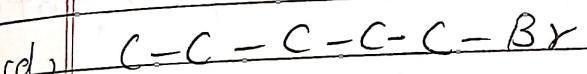
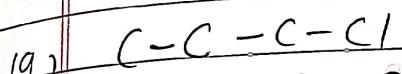
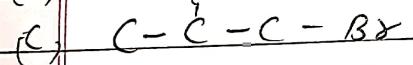
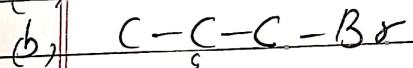
② (R-X) are soluble in H₂O but insoluble in

$\text{SO}_2 \text{ P}$

Organic Solvent (Benzene, ether).

- (a) B.P & no. of C. & mass of (Branch)

Arrange the following in ascending order.

 $\Rightarrow \text{A} \leq \text{E} \leq \text{C} \leq \text{B} \leq \text{D}$  $\text{B} \leq \text{E} \leq \text{C} \leq \text{D} \leq \text{A}$

(a) 1-Bromo-2-Methyl Pentane

(b) 1-Bromo Pentane

(c) 1-Chloro-2-Methyl Butane

(d) 1-Chloro-Butane

 $\text{D} \leq \text{C} \leq \text{B} \leq \text{A}$

Chemical Properties of $R-X^-$

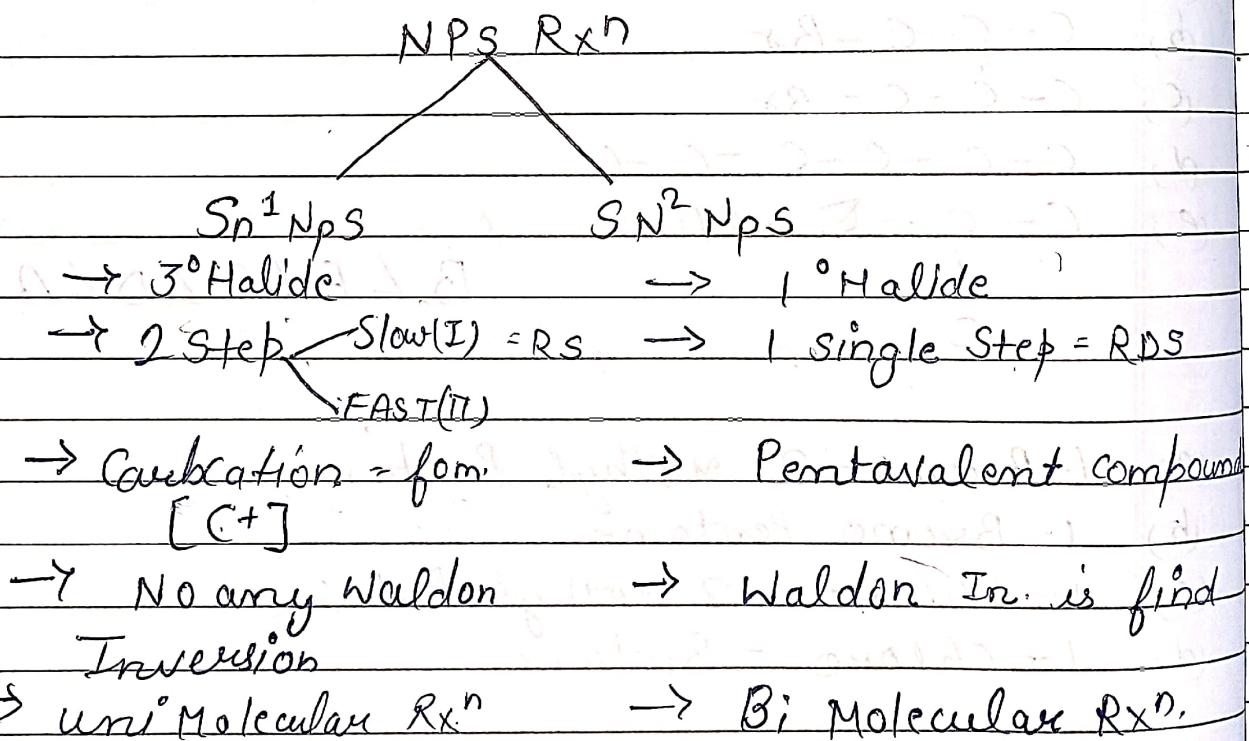
- (1) * Nucleophilic Substitution $R-X^n^-$
- (2) * Elimination $R-X^n$
- (3) React with metal
- (4) Reduction

① Nucleophilic Substitution $R-X^n^-$

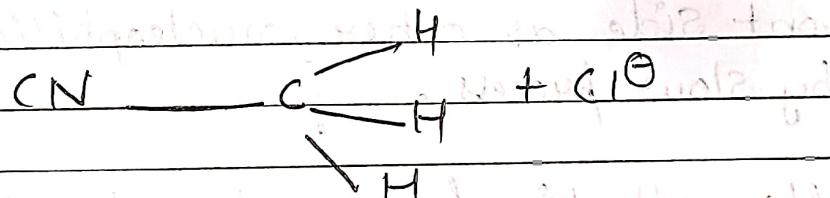
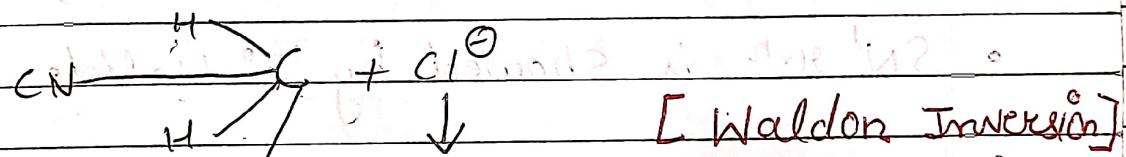
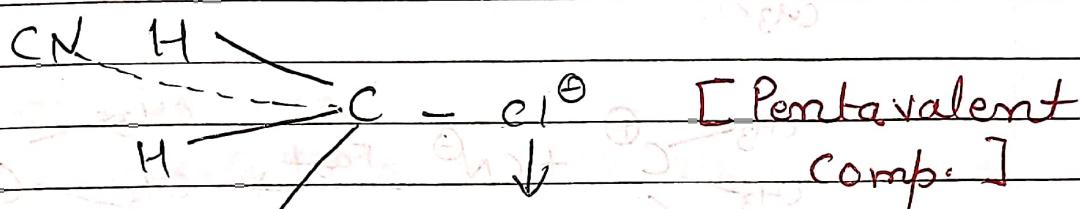
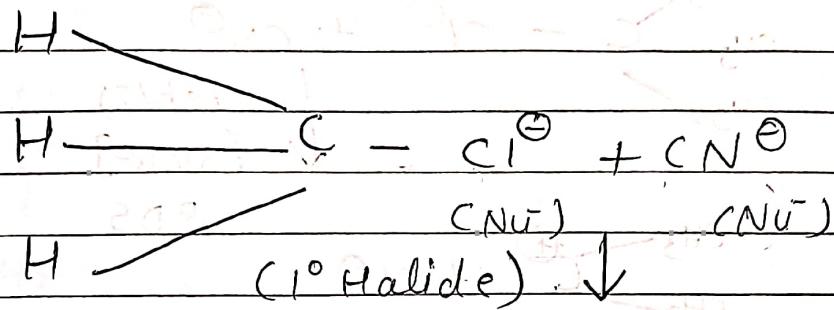
The $R-X^n$ in which high reactive nucleophilic is displaced by the low reactive nucleophilic that's known as NPS.

NPS $R-X^n$ are next two types -

- (1) $SN^1 Nps$
- (2) $SN^2 Nps$



→ $\text{Sn}^2 \text{ NPs}$



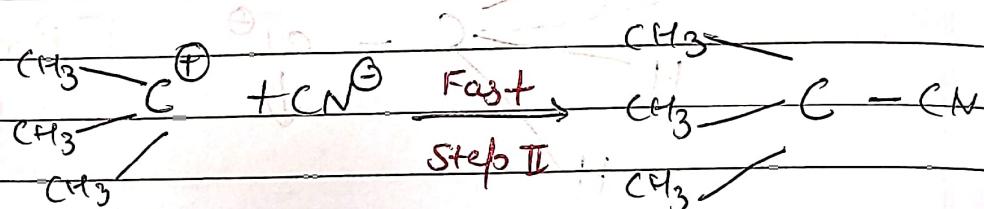
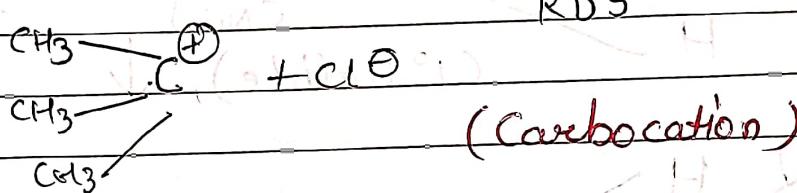
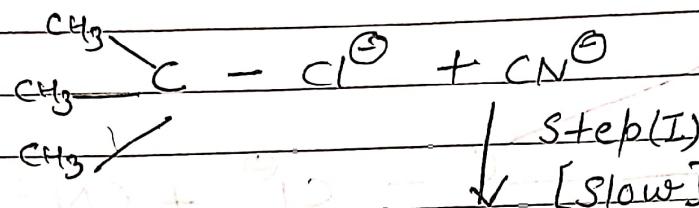
→ $\text{S}^{\text{N}}2 \text{ rxn}$ should be shown by 1° Halide.

→ In this rxn nucleophilic cannot attack directly it will attack from backside because repulsion force is present b/w \ominus ve & \oplus ve.

→ After attacking an imaginary product pentavalent compound is formed.

→ Finally the geometry of (H) is changed that is $\text{K/a Waldon Inversion}$.

→ SN^1 NPs

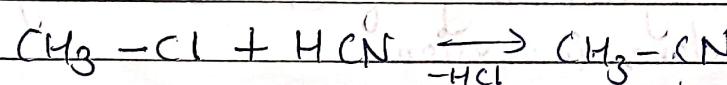


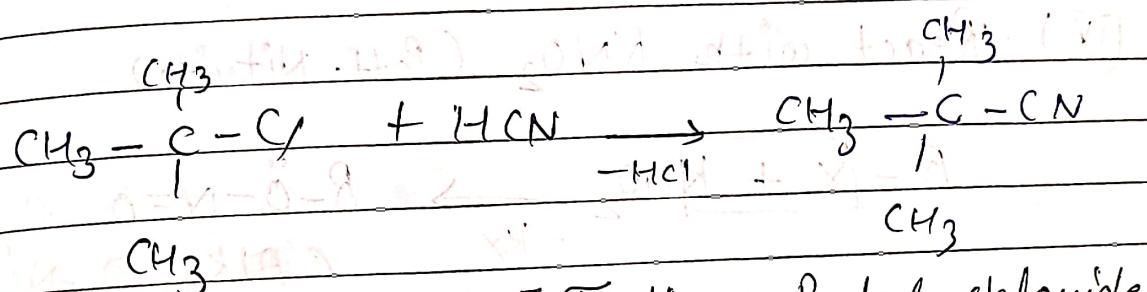
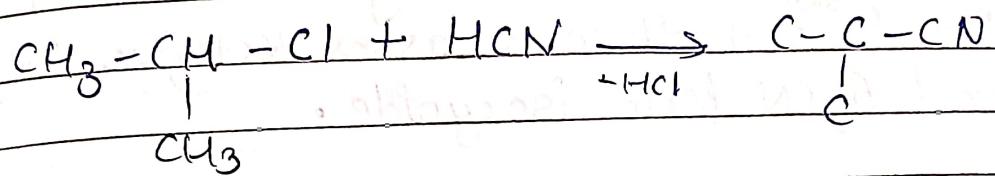
- SN^1 rxn is showed by 3° Halide.
- In this nucleophilic will attack directly from front side as other nucleophilic is detached by slow process.
- After attacking here carbocation $[\text{C}^{\oplus}]$ is formed which is a fast process to form the neutral compound.

Example of NPs rxn.

1) React with (HCN) .

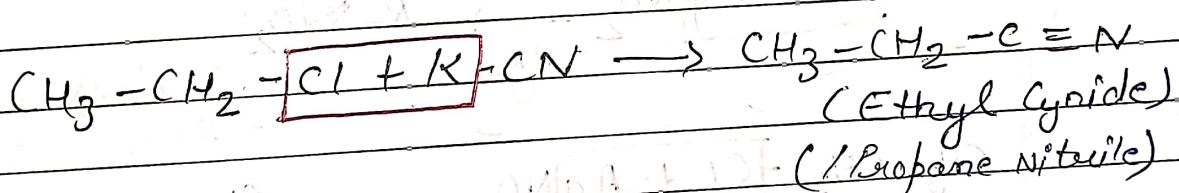
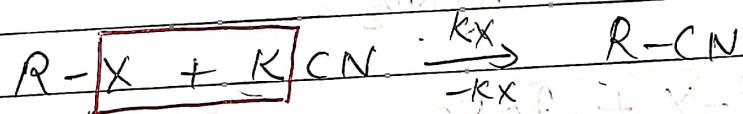
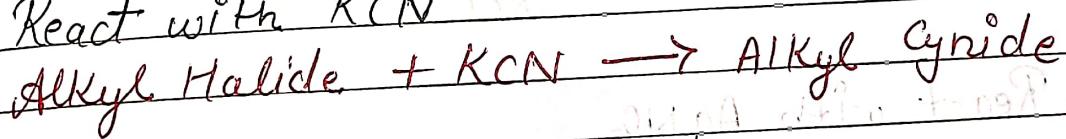
Alkyl Halide + HCN → Alkyl cyanide





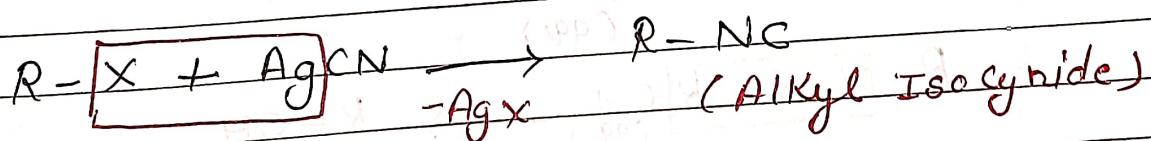
[Tertiary Butyl chloride]

(2) React with KCN



(1-Propane Nitrile)

(3) React with AgCN

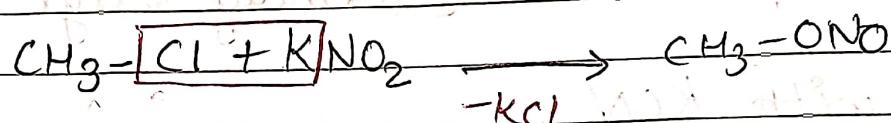
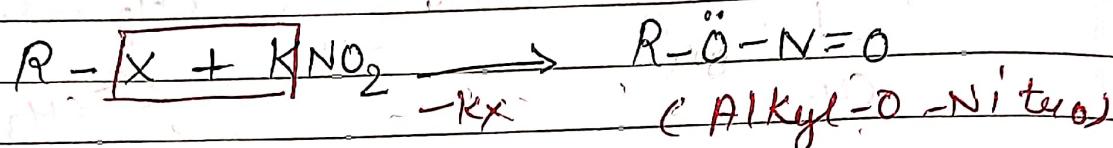


Ques Why Alkyl Halide is form Alkyl cyanide and Isocyanide after react with KCN and AgCN .

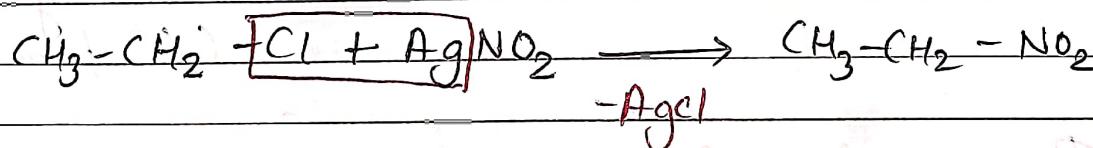
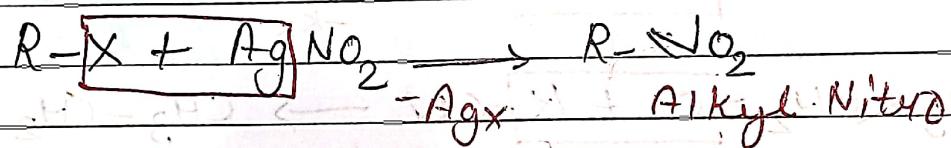
Ans We know that KCN is a ionic compound and AgCN is covalent compound. In KCN carbon

donate the e^- but in AgCN N atom donate the e^- due to. Both these reasons KCl for Alky cyanide and AgCN form isocyanide.

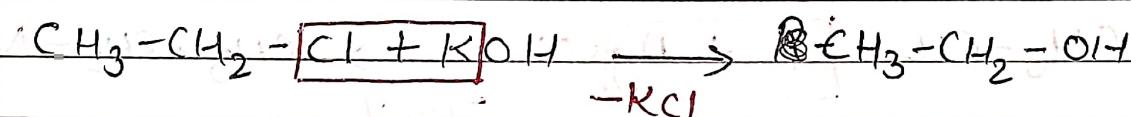
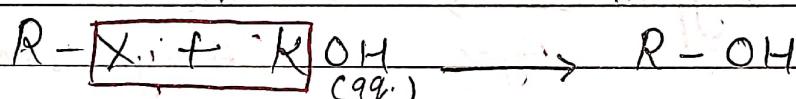
(IV) React with KNO_2 (Pott. Nitrite)



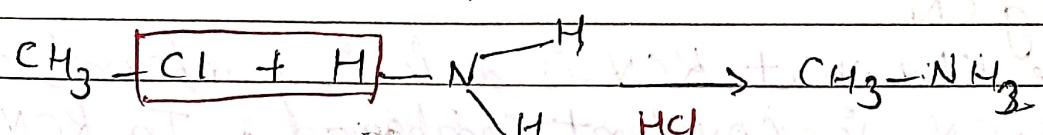
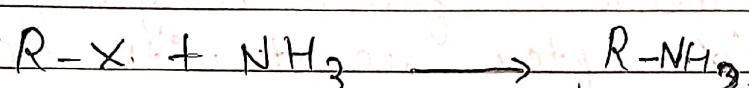
(V) React with AgNO_2

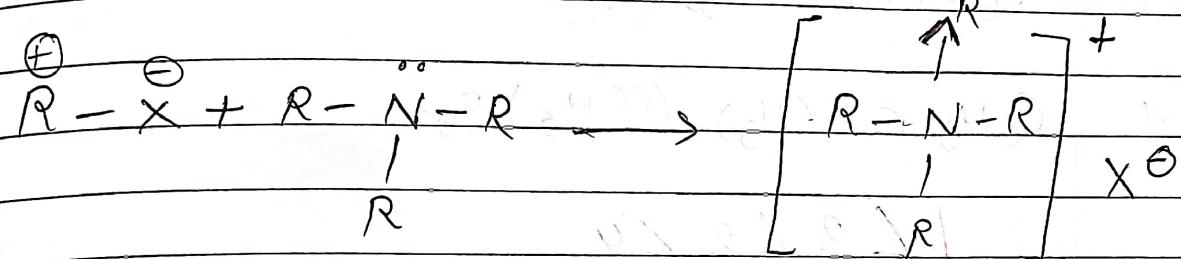
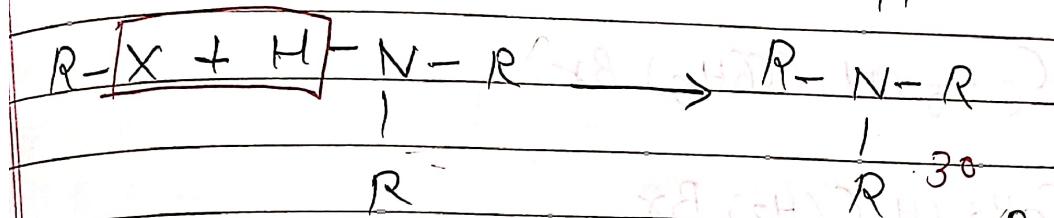
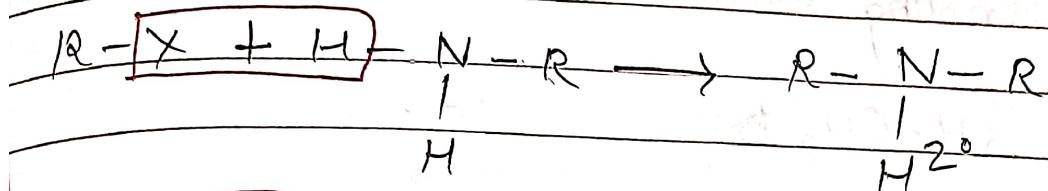
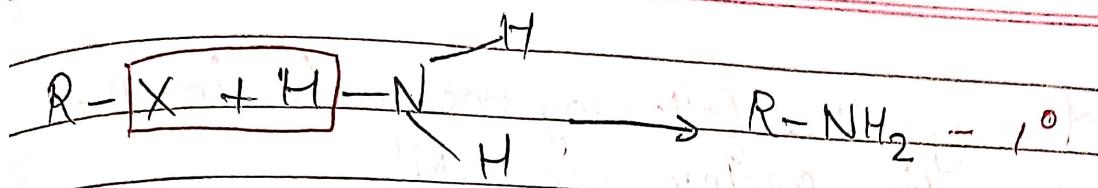


(vi) React with KOH



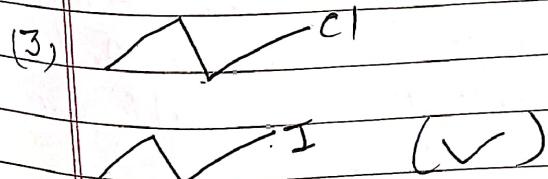
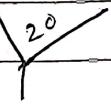
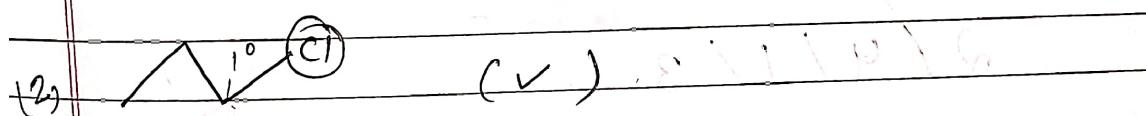
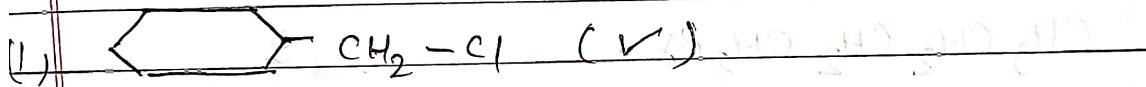
(vii) React with Ammonia



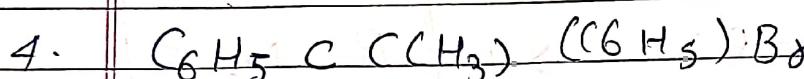
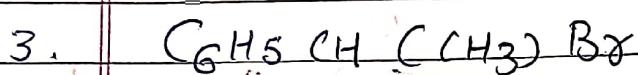
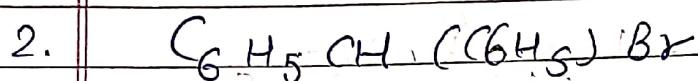
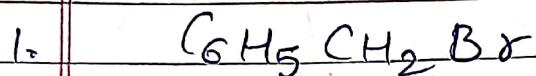


(Tetra Salt)

Q) In the following pair of Halogen Compound which will be give S_N^2

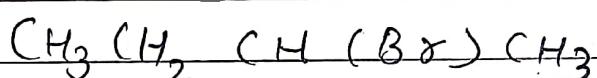
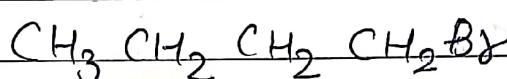
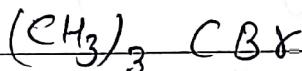
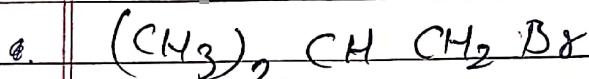


Arrange the following molecule in the ascending order for S_N^1



1 < 3 < 2 < 4

(S_N^2)



2 < 4 < 1 < 3

① Elimination Rxn

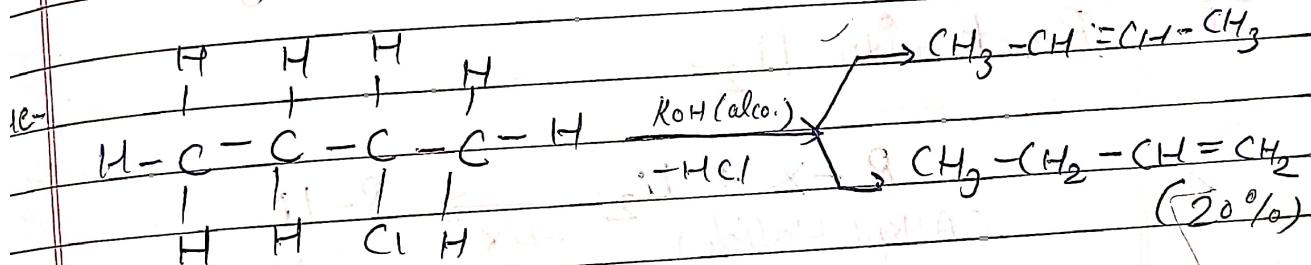
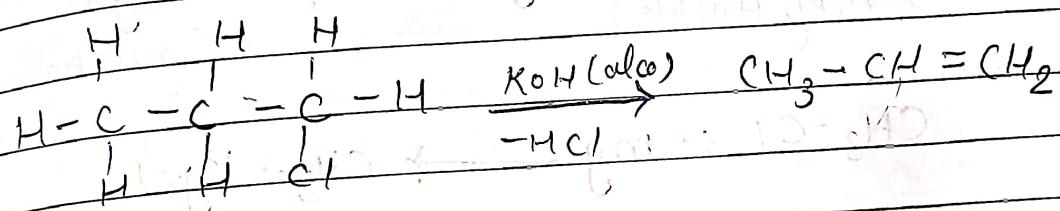
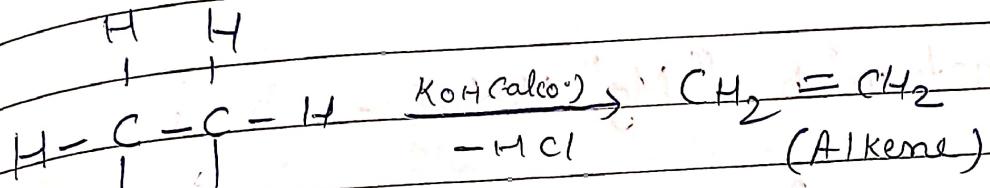
When the alkyl halide react with alcoholic KOH than after remove of HX two - bond is break and 1 π Bond is formed. And Alkyl halide is convert into Alkene that's why known as Elimination Rxn.

Alkylhalide

 $\xrightarrow{\text{KOH (alco)}}$ Alkene

2 - Bond break

1 π Bond Form



Saytzeff Rule -

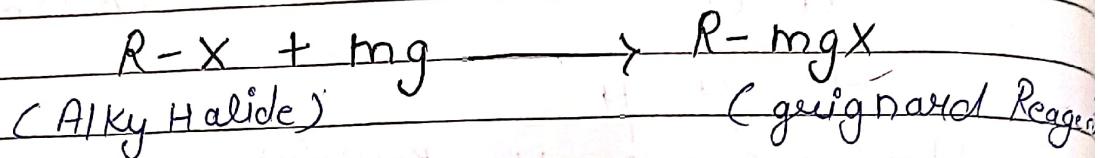
Acc to Saytzeff Rule there are some type Alkyl halide which react with alcoholic KOH than they form of two types of Alkene. But those alkene which have no. of alkyl is maximum is more into. Ex -

When 2-chloro Butane React with alcoholic KOH then acc to Saytzeff rule major product is 2-Butene and Minor product 1-Butene.

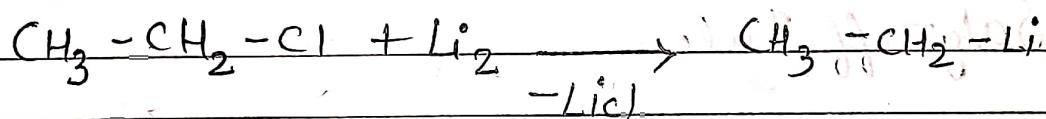
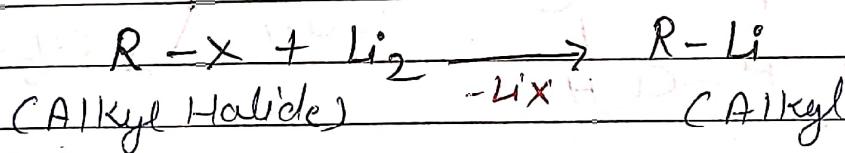
① React with metal

Grignard :-

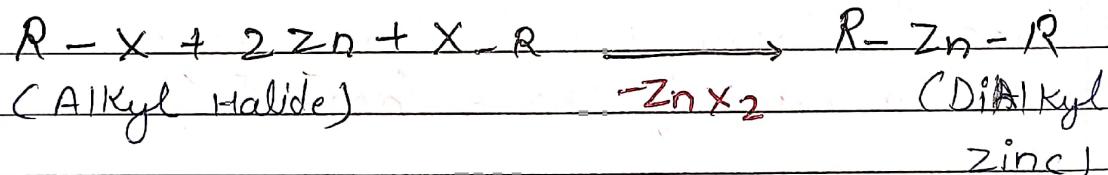
I React with "Mg" Metal -



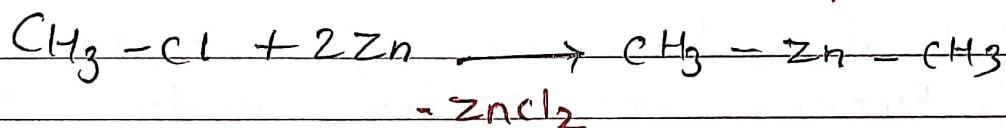
II React with Li_2 -



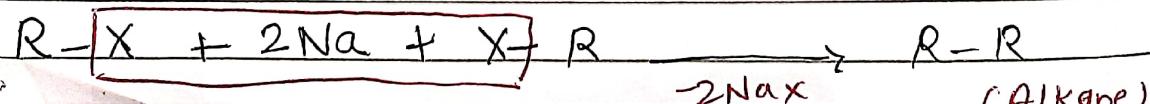
III React with Zn -

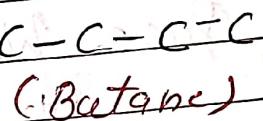
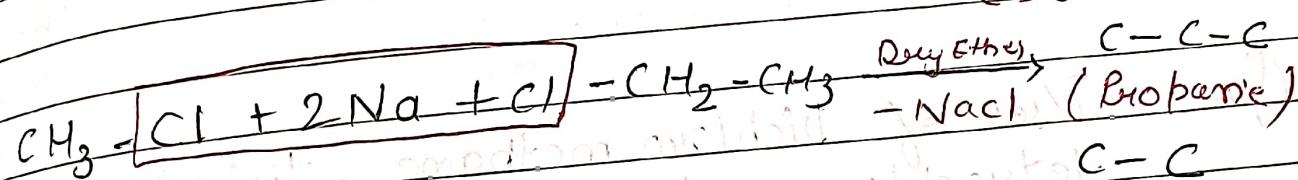
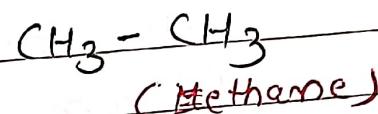
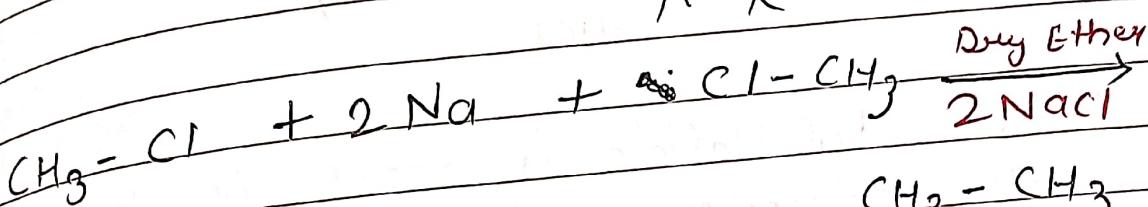
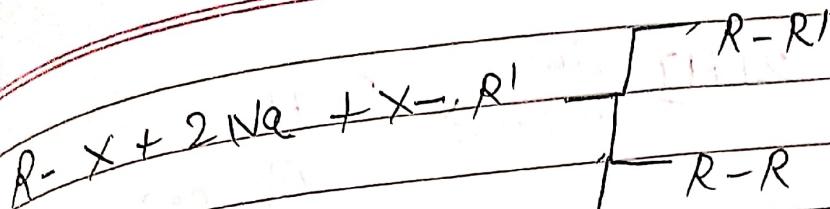


[Frankland Reagent]



IV React with Na (Wurtz's Rxn)

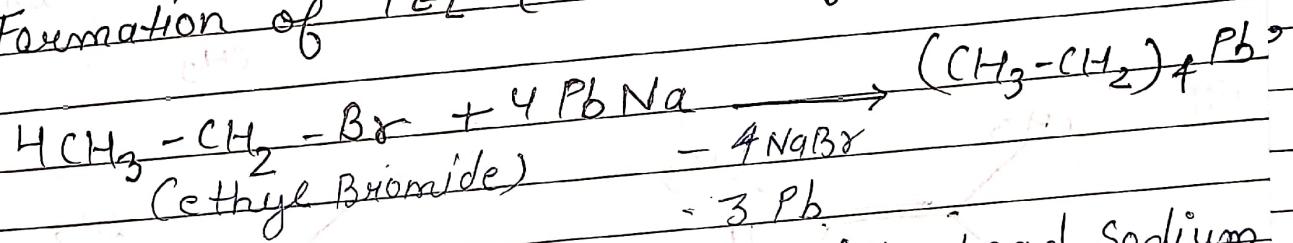




~~Na~~

(V) React with Pb (Lead) -

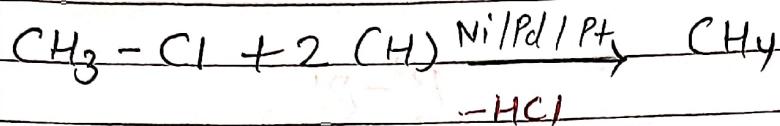
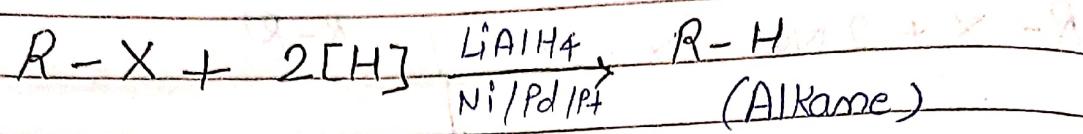
Formation of TEL (Tetra Ethyl Lead) -



=> When Ethyl bromide react with lead Sodium then Sodium bromide or Lead is remove and Tetra Ethyl lead is formed.

=> TEL is used as a anti knock agent in fuel.

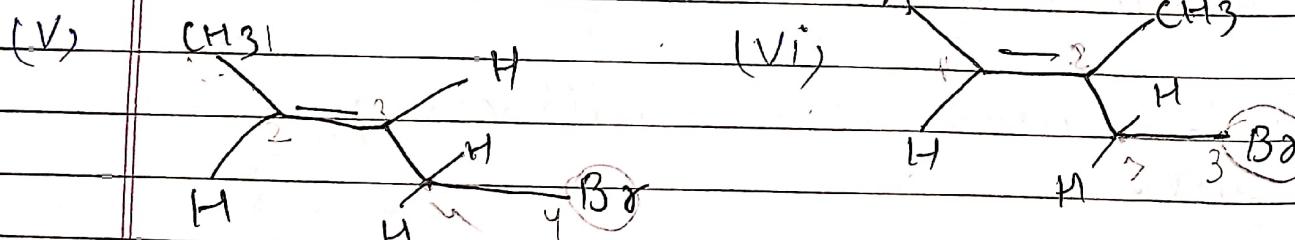
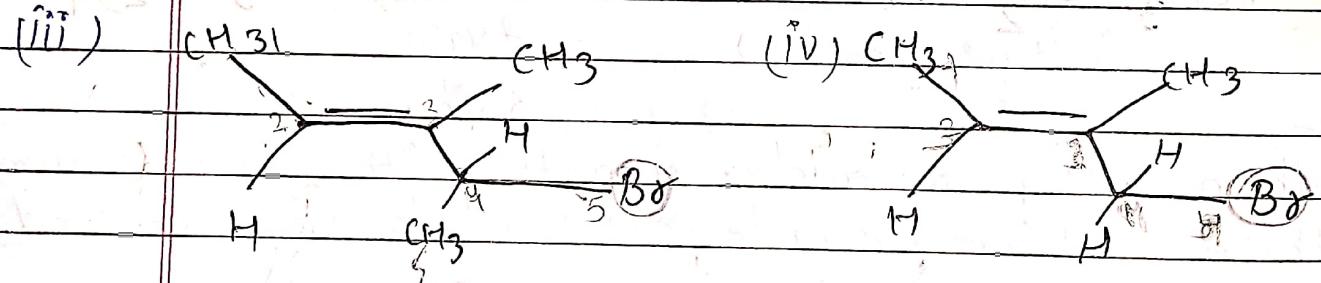
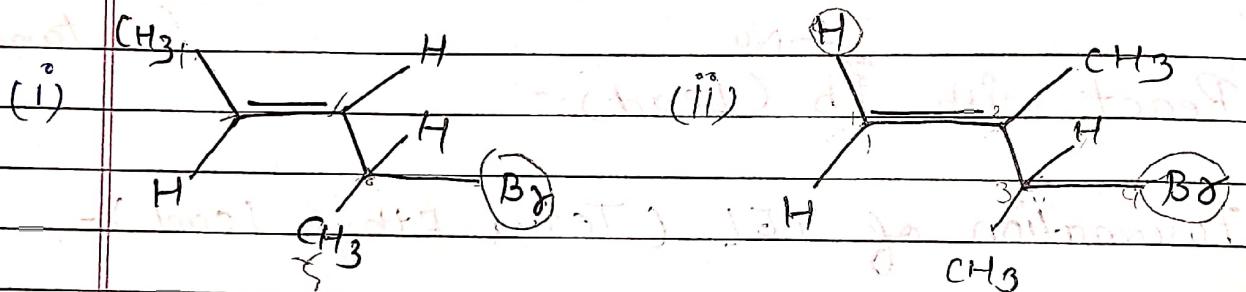
(VI) Reduction of R-X -



When alkyl Halide is react with hydrogen in the presence of LiAlH_4 , Ni/Pd/Pt then Alkane is form.

Ques. Uses of Dichloro methane, trichloro methane, tetrachloro methane, tetra Iodo methane.

Ques. Write IUPAC name-



(i) 4-Bromopent-2-ene.

- (iii) 3-Bromo-2-methyl But-1-ene.
- (iii) 4-Bromo-3methyl Pent-2-ene.
- (iv) 4-Bromo-2 methyl but-2-ene .
- (v) 1-Bromo Pent-2-ene .
- (vi) 3-Bromo - 2-methylpentpropene.

Dichloro methane - [methylene chloride]

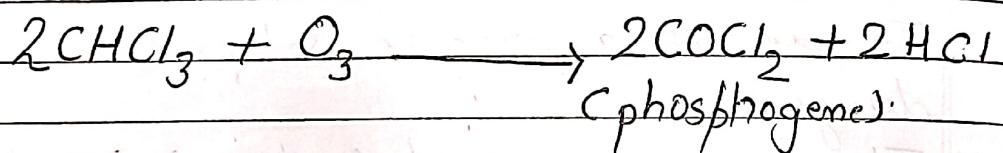
- DCM is widely used as a Solvent as paint remover.
- It also use as propellant in aerosols.
- It use as a process Solvent in manufacture of drugs.
- It also use as metal cleaning and finishing Solvent.
- Methylene chloride harms the human CNS.
- Exposure of lower level of methylene chloride in air can lead slightly impaired hearing and Vision.
- Higher level of it in air cause dizziness, nausea, tingling and numbness of fingers & toes.
- Direct contact with skin cause intense burning and mild redness of skin and with eyes it burn the cornea.

Trichloro methane - [Chloroform]

- Chloroform is employed as a Solvent for fats, alkaloids, iodine and other substance .
- It use as production furen refrigerant R-22.
- Inhaling chloroform vapours depresses the CNS .
- chronic chloroform exposure may cause damage to

liver and kidney.

- Breathing about 900 parts of chloroform per million part of air (900 parts per million) for short time cause dizziness to liver fatigue and headache.
- Chloroform is slowly oxidised by air in the presence of light to extreme poisonous gas Carbonyl chloride also known as phosgene. So it is stored in dark colour bottles and completely filled so that air is kept out.



Tetrachloro methane [Carbon tetrachloride].

- It use in manufacture of refrigerants and propellants for aerosol cans.
- It use as feedstock in the synthesis of chlorofluorocarbon and other chemicals.
- Some evidence expose to it cause liver cancer in humans. Most common effects are dizziness, light headache, nausea and vomiting which damage nerve cell.
- Expose to CCl_4 can make the heart beat irregular.
- When CCl_4 release in air it depletes the ozone layer.

Triiodo methane [Iodoform].

- It is use as antiseptic earlier, the antiseptic

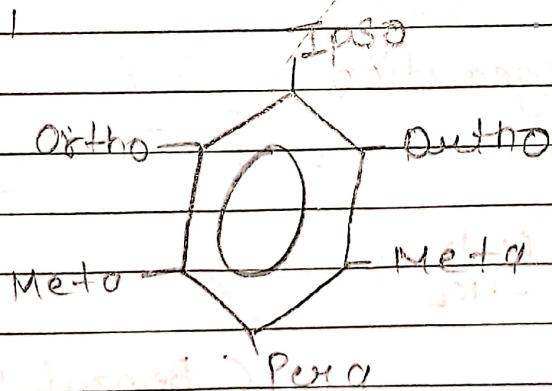
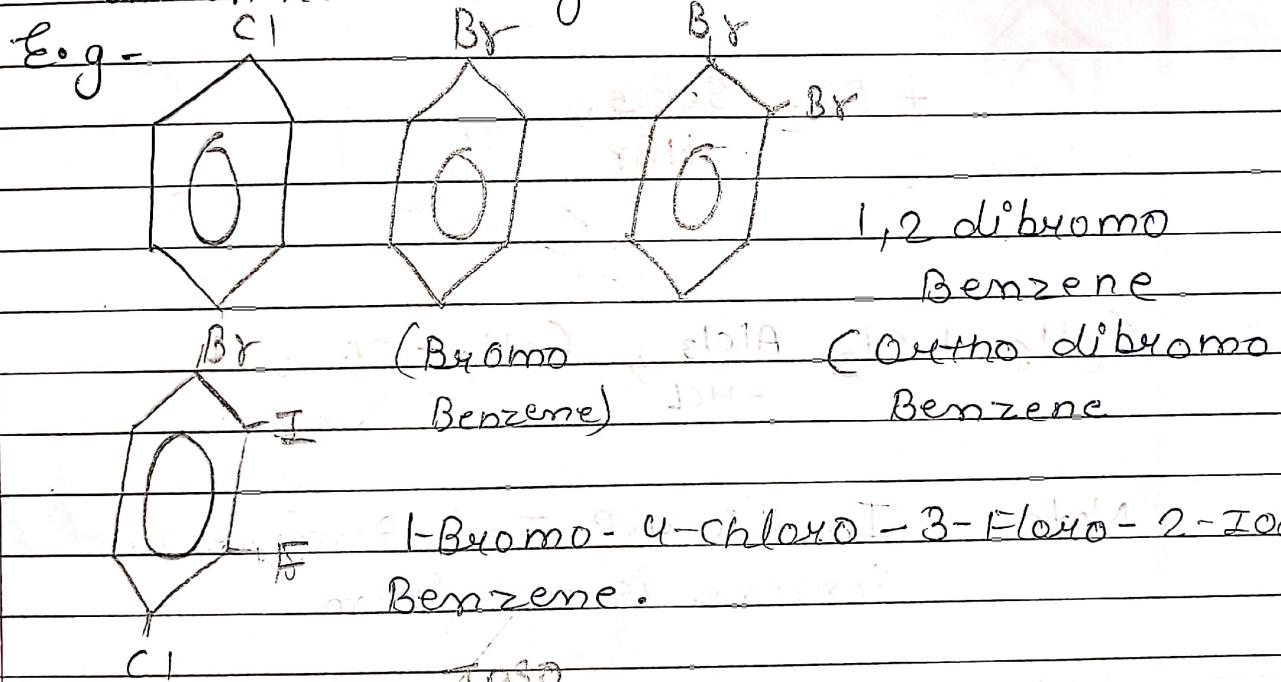
Properties are due to liberation of free iodine and not due to iodoform itself. Due to its obnoxious smell, it has been replaced by other formulations containing iodine.

Halo Aromatic / ARX_n Halide -

If any Halogen atom bonded directly from benzene, this known as Halo Aromatic or Aryl Halide.

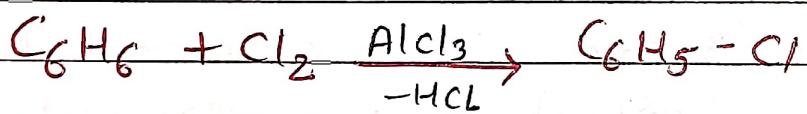
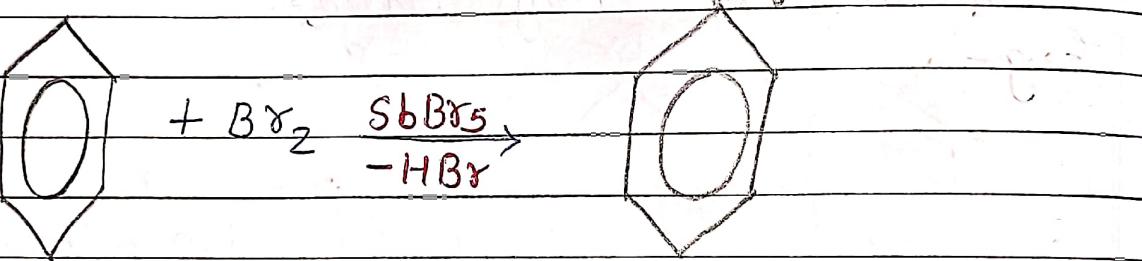
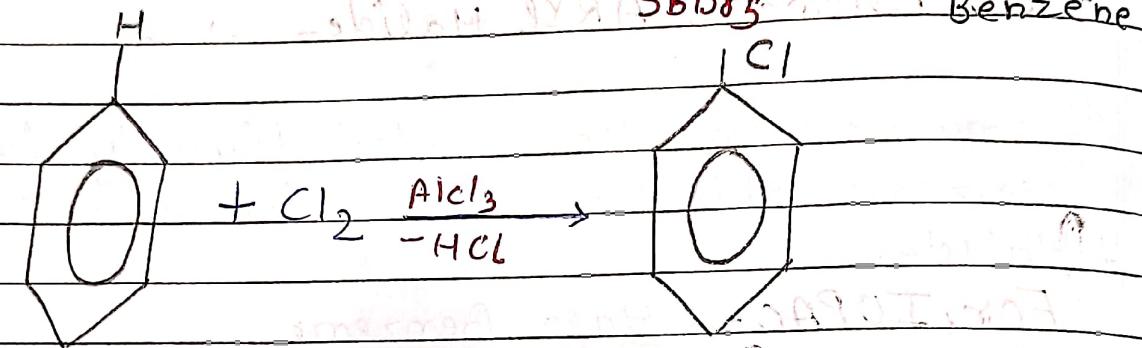
For IUPAC - Halo Benzene.

Common name - Aryl Halide.



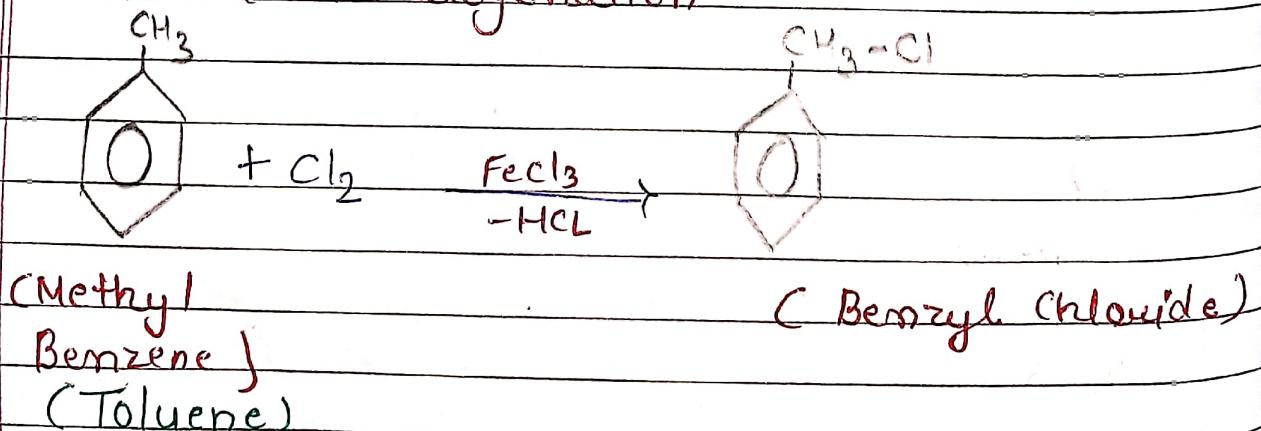
Formation of Halo Aromatic Compounds -

I From Benzene (Halogination)

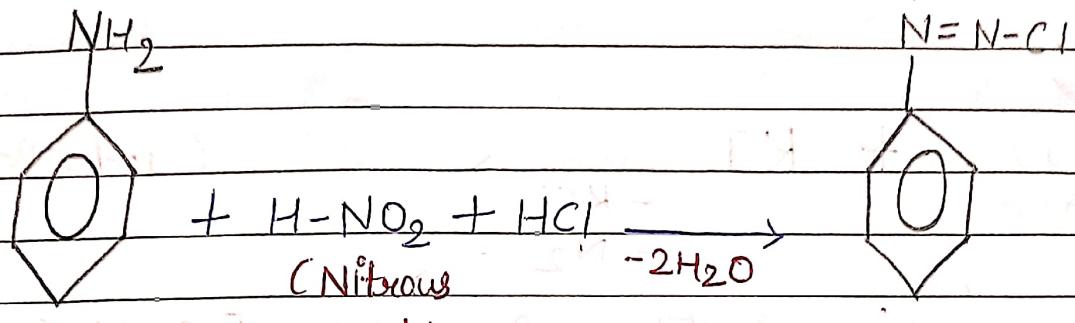


Note - In this rxn Iodo Benzene and Fluoro Benzene is not form.

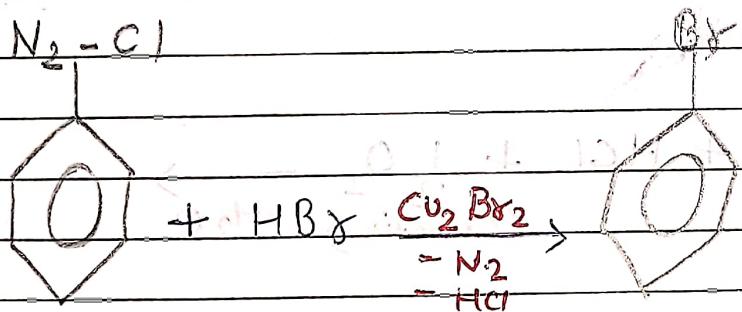
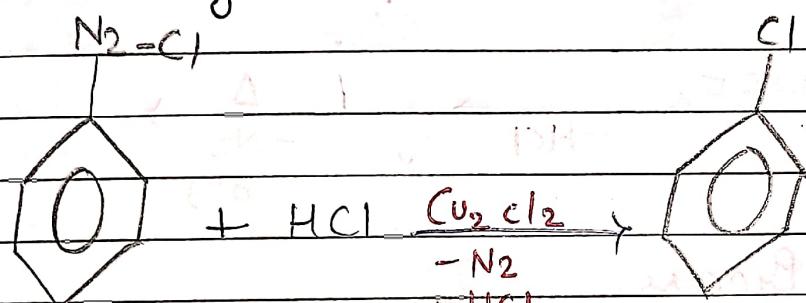
II Side Chain Halogenation



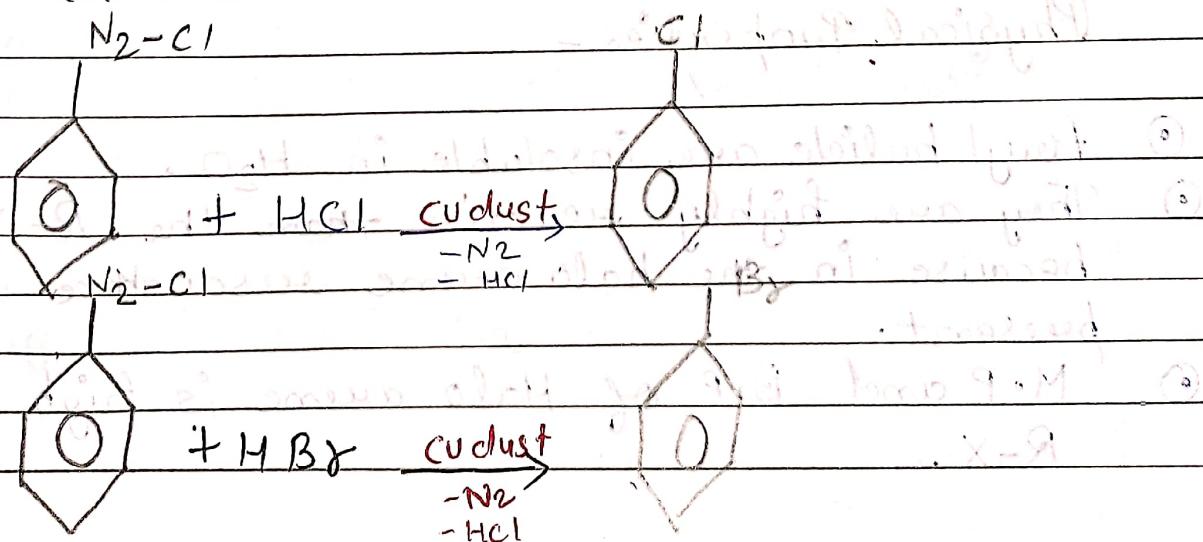
III From B-D-C [Benzene Diazonium chloride]

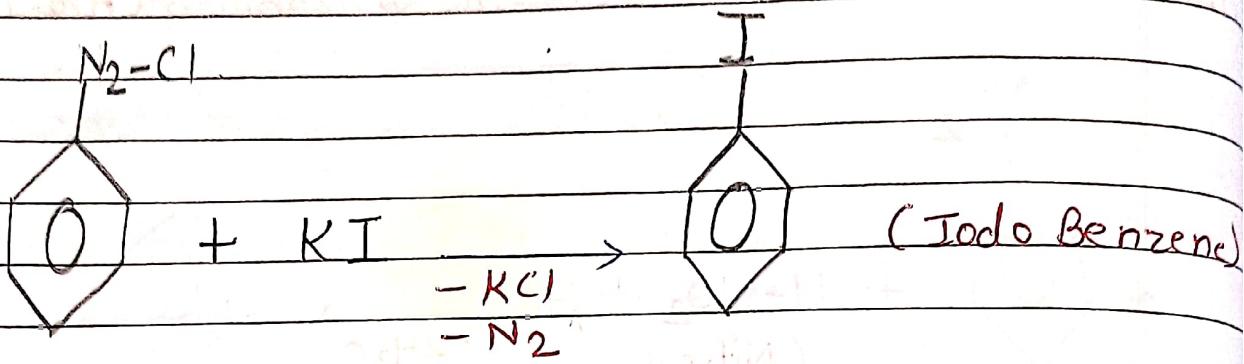


Sandmayer Rxn

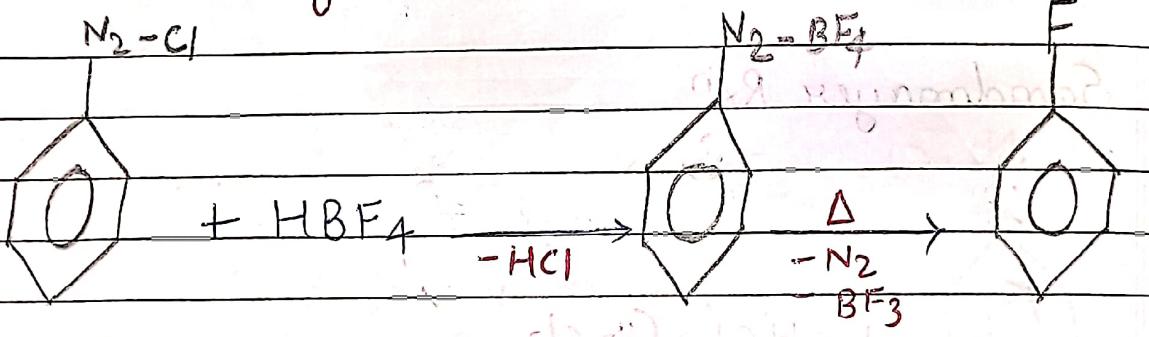


Grattermann Rxn

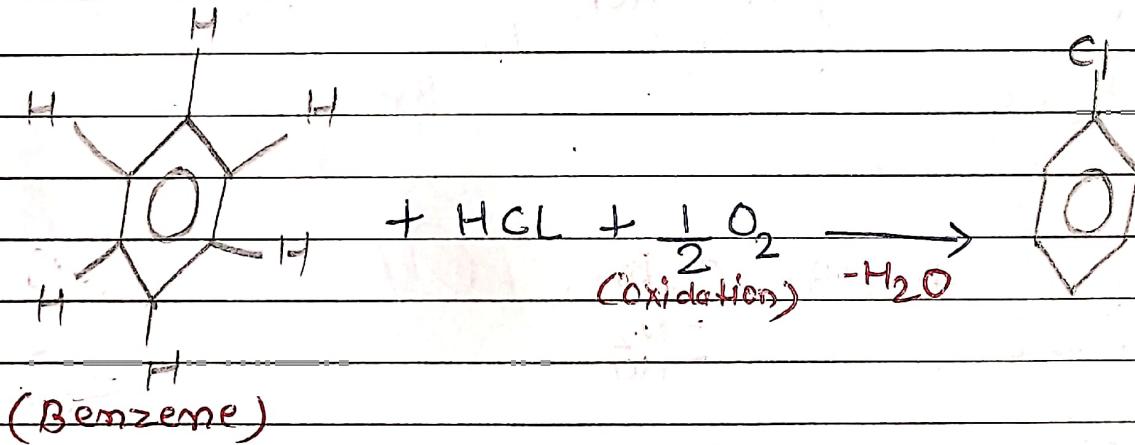




(V) Formation of Fluoro Benzene - [Boltz'smann Rx]



(VI) ROSCHINGER Process.



Physical Properties -

- ① Aryl halide are insoluble in H_2O .
- ② They are highly reactive than the R-X because in the halo arene resonance is present.
- ③ M.P and B.P of Halo arene is high than R-X .

Chemical properties -

(i) Electrophilic Substitution RX^n [EPS]

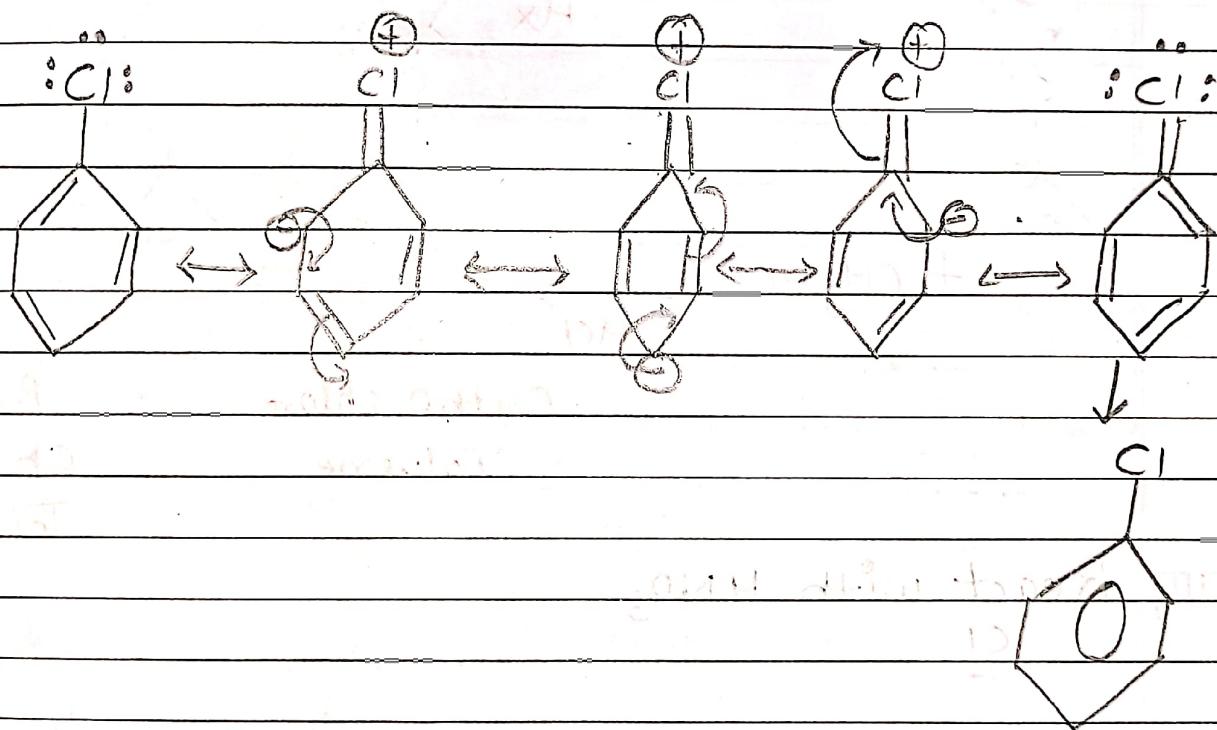
(ii) React with metal

(iii) Coupling RX^n

(iv) Extra

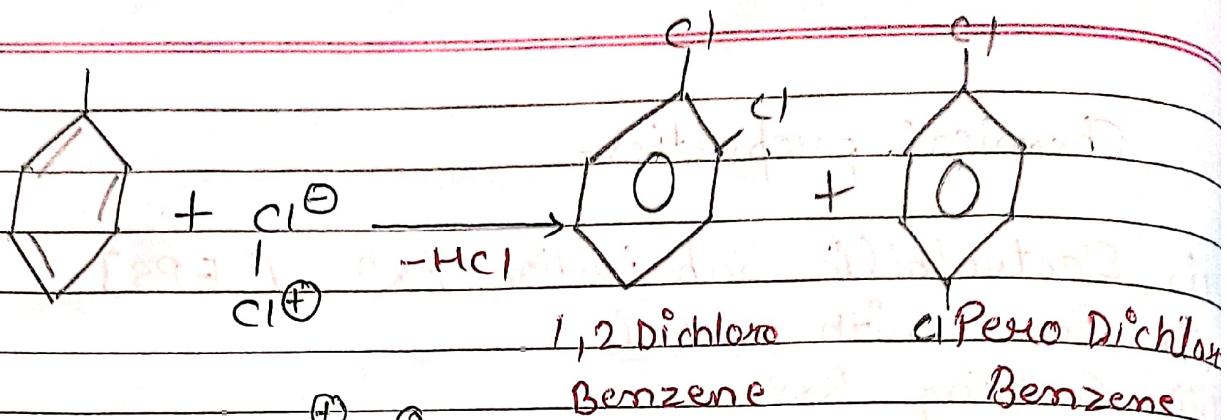
(i) Electrophilic Substitution RX^n

(a) Resonance structure of $X-PH_3$

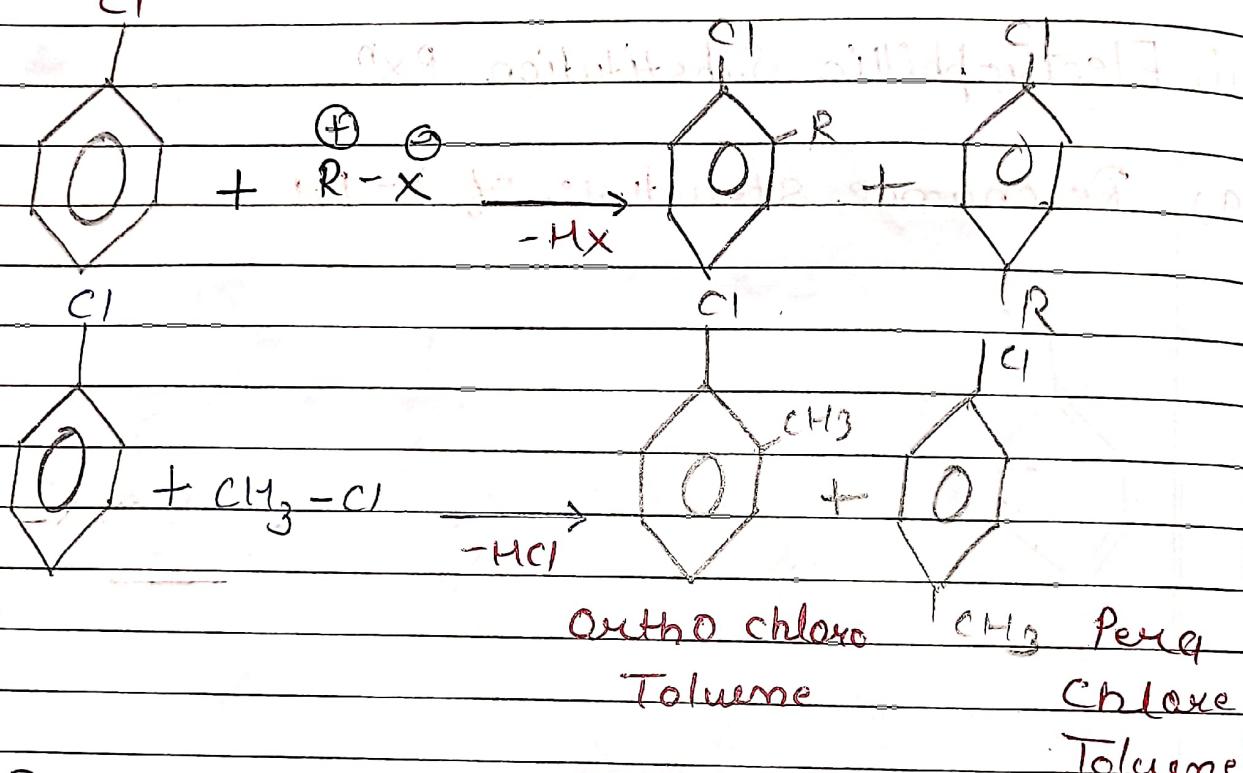


In the resonance structure of chlorobenzene the negative charge (electron density) is present on ortho or Para position so electrophilic group is attack on Ortho or Para Position and their are two product is formed.

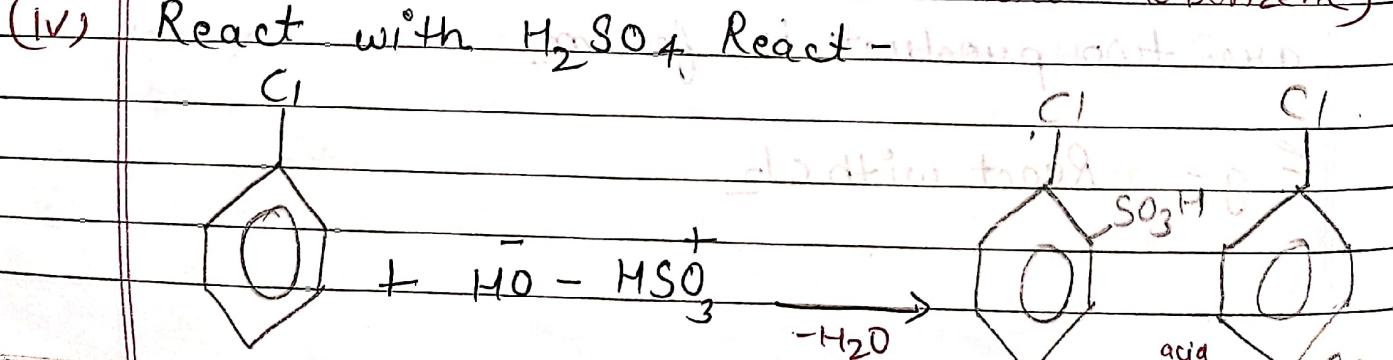
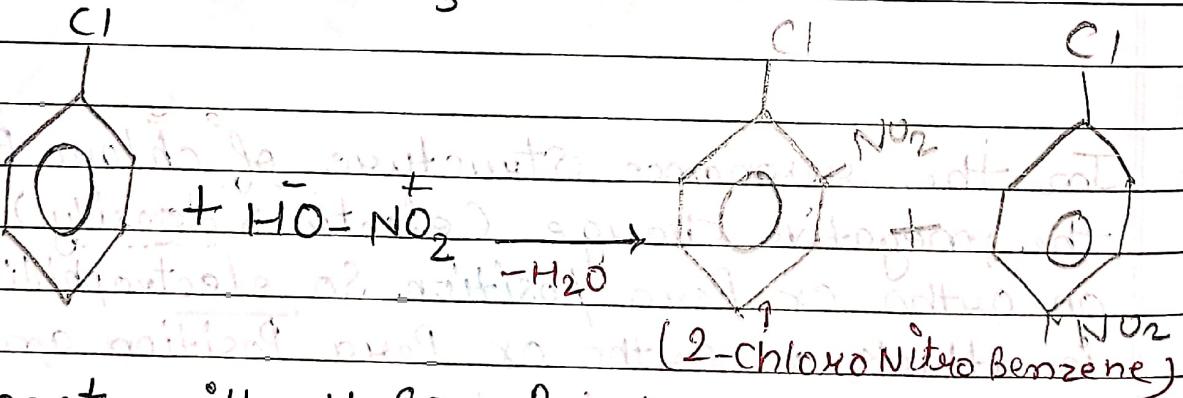
E.g - (i) React with Cl_2



(II) React with $\text{R}-\text{X}$.



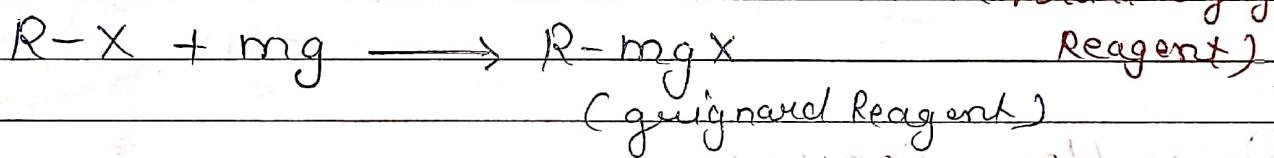
(III) React with HNO_3 .



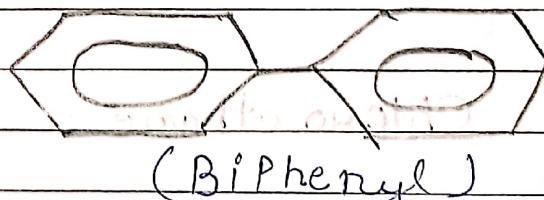
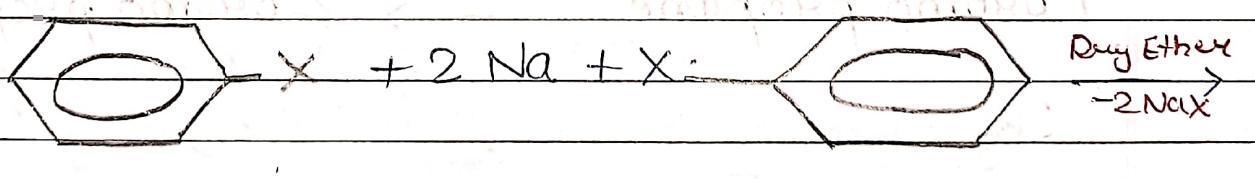
Ques- Why R-X are given NPS but Ph-X are give EPSC reaction.

(ii) React with Metal :-

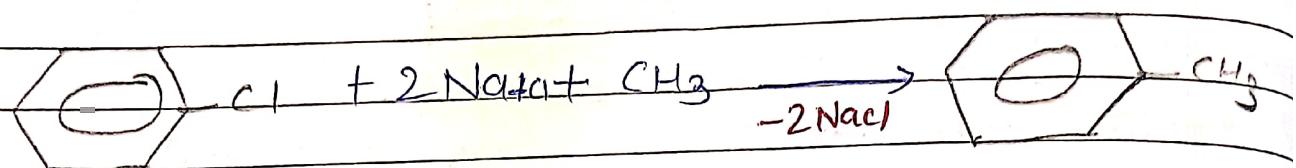
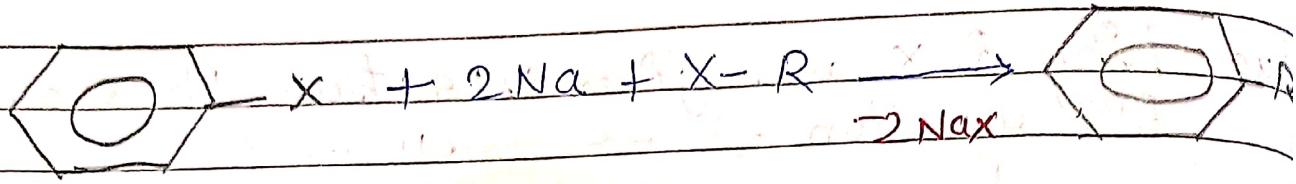
1. Mg Metal -



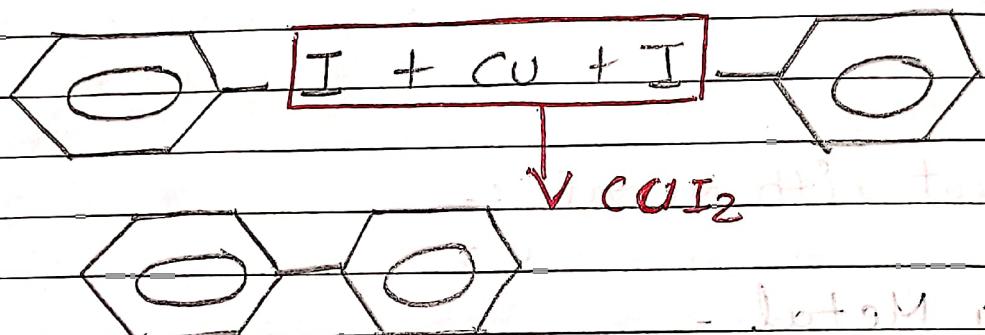
2. React with Na (Fitting RX^n)



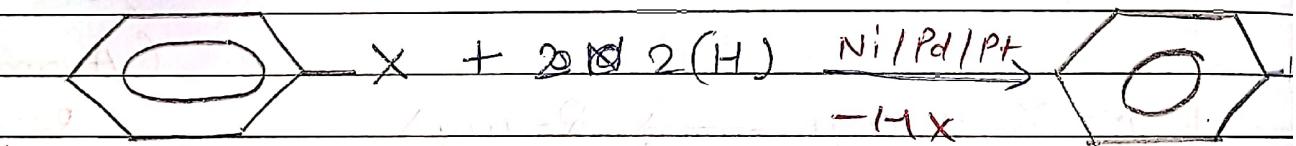
3. Wurtz's Fitting RX^n -



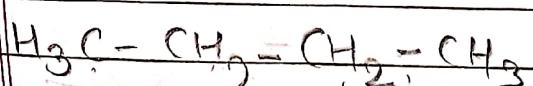
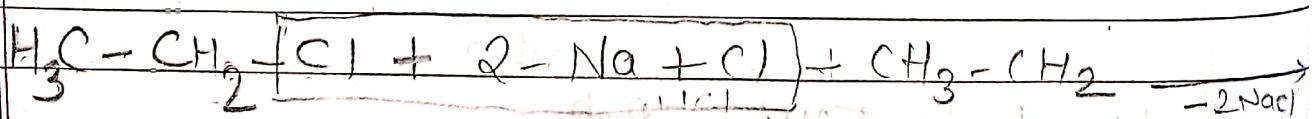
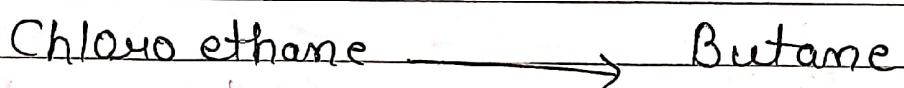
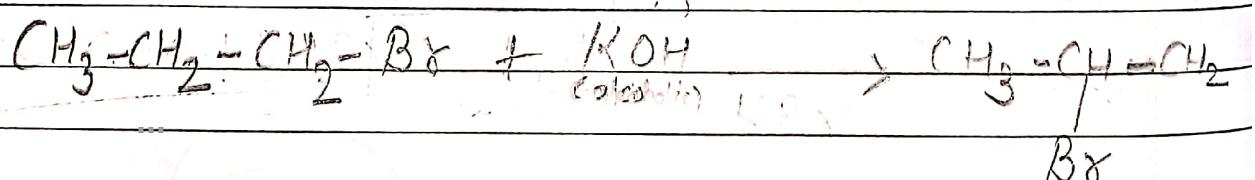
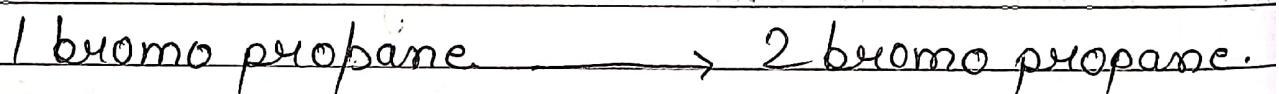
Ullmann Rxⁿ-



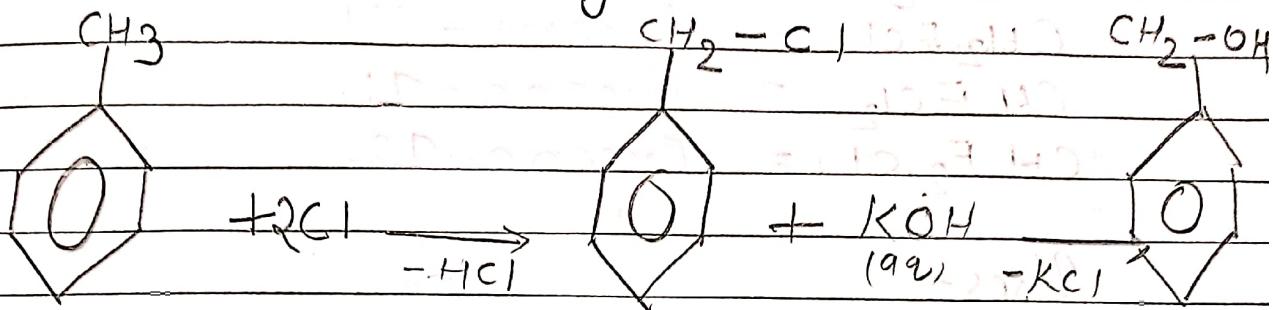
Extra Rxⁿ (Reduction)



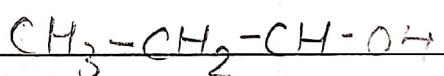
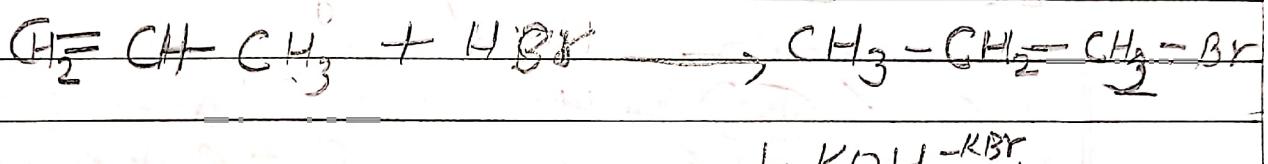
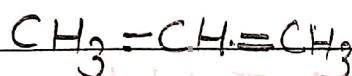
Ques - Hough Converse -



Toluene \rightarrow Benzyl alcohol:



Propene \rightarrow Propane-1-ol



Note:- Generally

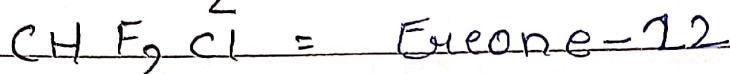
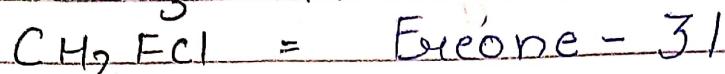
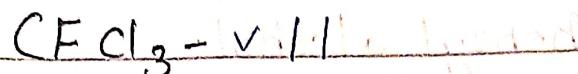
Freones :- [C.F.C = chloro Fluro Carbon]

- The compound in which C, F, Cl and H will be present that's compound are known as C.F.C & Freones.
- If carbon atom completed its Valency by Cl, F, H atom that compound is known as C.F.C or Freone.

E.g. CF_2Cl_2 = Freone - 12

$\text{C}_2\text{H}_2\text{F}_2\text{Cl}_2$ = Freone - 132

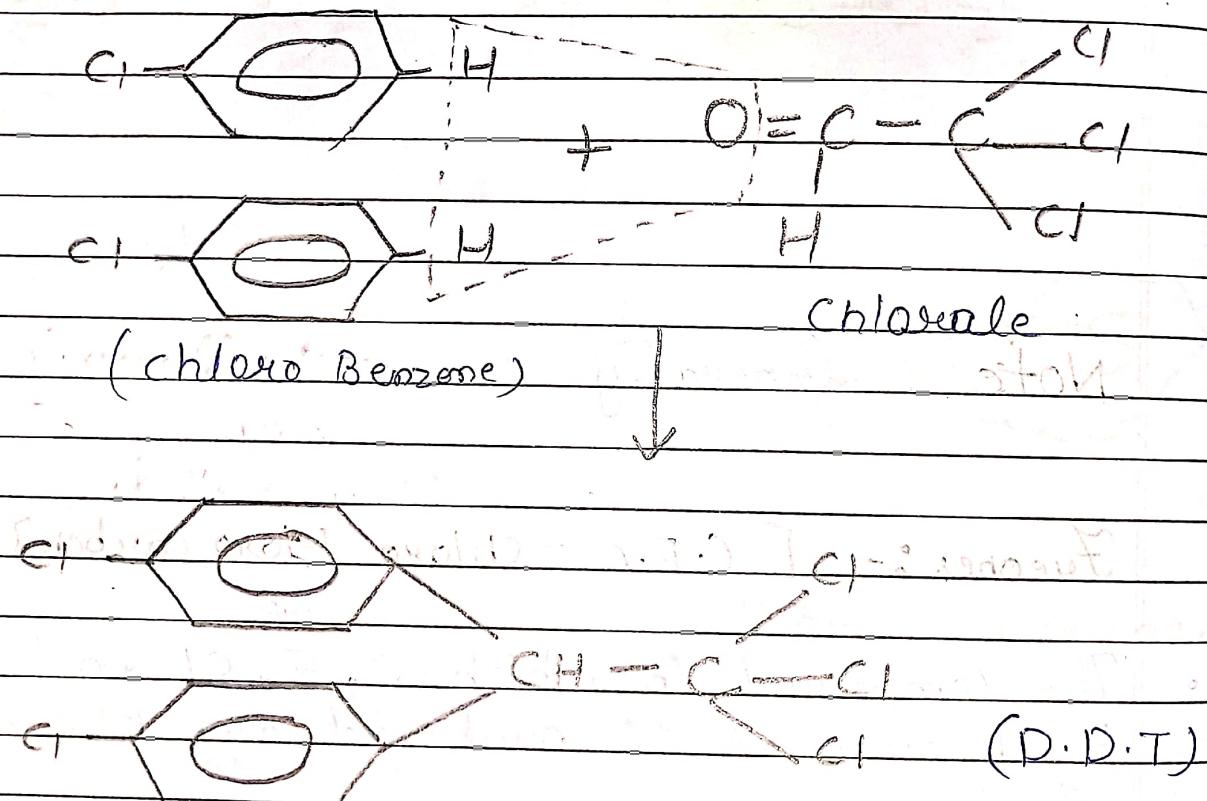
Erieone



Uses -

- Erieones are used as a coolent in A.C and Refrigerator.

DDT - [Dichloro Diphenyl Trichloro Ethane]



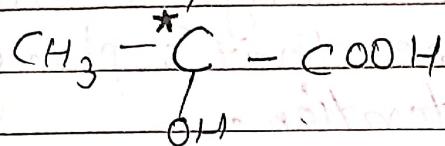
Some important Definitions -

(1) Chiral Carbon & chirality -

The carbon atom which have all valency different to each other that is known as chiral Carbon

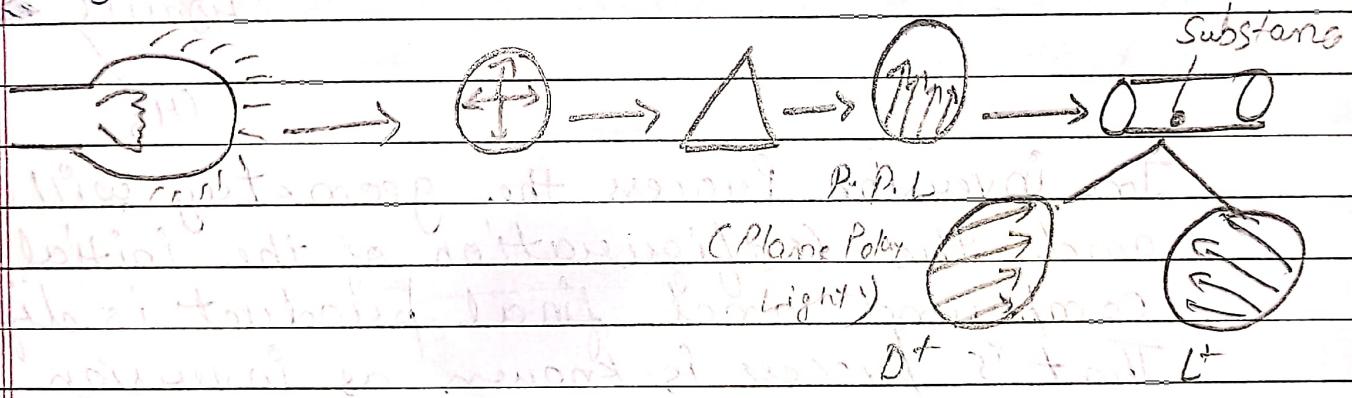
and the compound in which chiral carbon is present that is known as chiral compound.

E.g. -



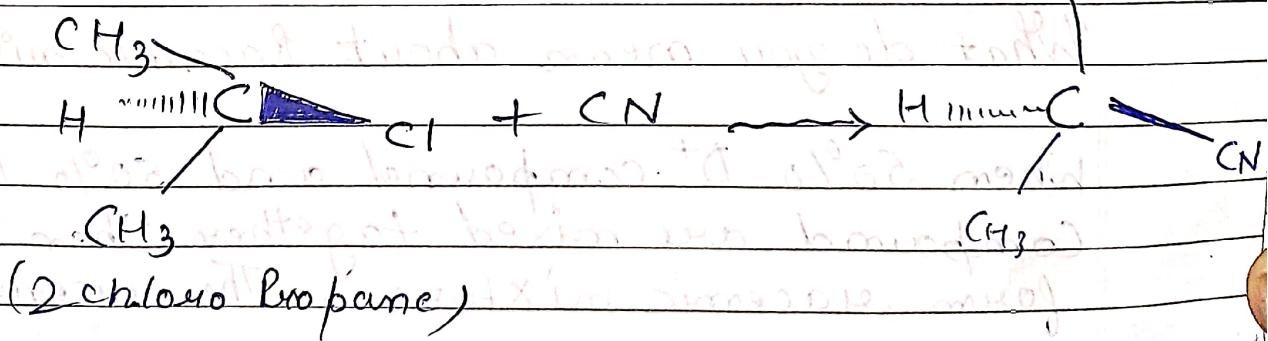
Optical Active-

The compound which have atleast one chiral carbon or which is show optical isomerism that's are optical active because these compound will be rotate the P.P.L in dextrorotatory and Laevorotatory. So that's why compound is D⁺ and L⁺.



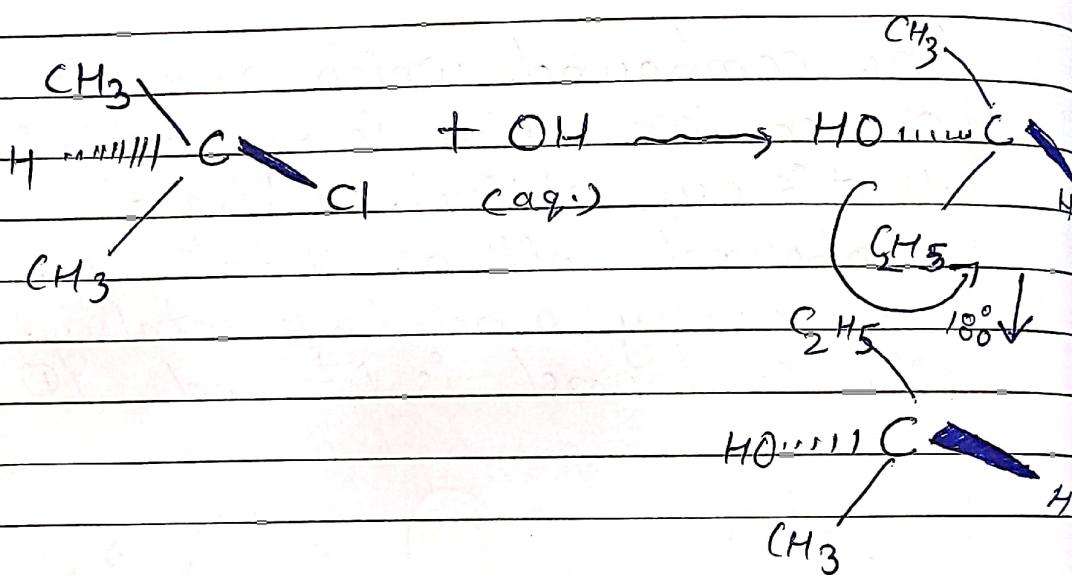
Inversion and Retention configuration -

Retention configuration :-



In the Retention Process the attacking group is attack, than after remove weak atom or group the geometry will not never be change, it means configuration is always same that's phenomenon is known as Retention.

Inversion configuration-

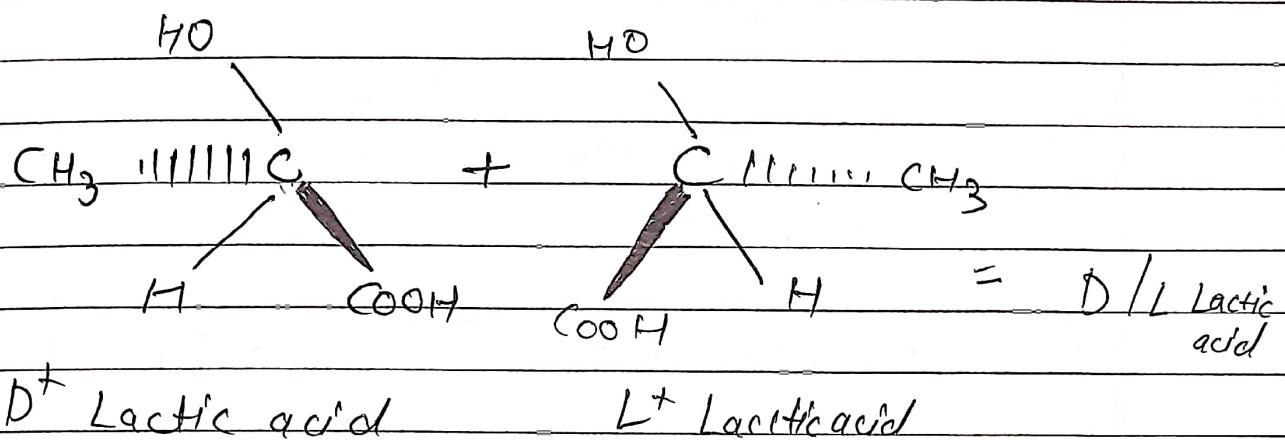


In inversion process the geometry will change and the configuration of the initial compound and final product is different. That's process is known as inversion configuration. Inversion configuration is present in S_N^2 NPs exⁿ.

What do you mean about Racemic mixture?

When 50% D⁺ compound and 50% L⁺ compound are mixed together then they form racemic mixture. The racemic

mixture can't be rotate the mixture in any direction. The formation method of Racemic mixture is known as Racemisation.



Enantiomer

The mirror diagram of compound does not superimpose the main compound that's are known as enantiomers.

E.g -

