HALOALKANES
&
HALOARENES

CLASS XII

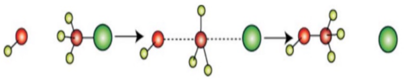
BOARD EXAM

These notes have been verified by top faculties & CBSE Science Toppers

↳ Target 100

↳ Previous Year Q's Integrated

Aman Dhattarwal



Flow Chart

Haloalkanes and Haloarenes

Methods of preparation

- From Alcohols
- From Hydrocarbons
- Halogen Exchange

Classification

Nomenclature

Nature of C–X bond

$$R\text{–}OH + HX \xrightarrow{ZnCl_2} R\text{–}X + H_2O$$

$$R\text{–}OH + NaBr + H_2SO_4 \longrightarrow R\text{–}Br + NaHSO_4 + H_2O$$

$$3R\text{–}OH + PX_3 \longrightarrow 3R\text{–}X + H_3PO_3 \quad (X = Cl, Br)$$

$$R\text{–}OH + PCl_5 \longrightarrow R\text{–}Cl + POCl_3 + HCl$$

$$R\text{–}OH \xrightarrow[X_2=Br_2, I_2]{\text{red } P/X_2} R\text{–}X$$

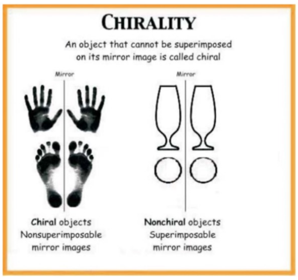
$$R\text{–}OH + SOCl_2 \longrightarrow R\text{–}Cl + SO_2 + HCl$$

Physical Properties

- B.P.
- M.P.
- Solubility

Reactions of Haloalkane

- Nucleophilic Substitution
- S_N1 and S_N2
- Elimination Reaction
- Reaction with metals

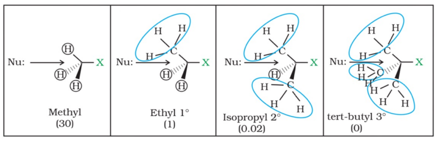


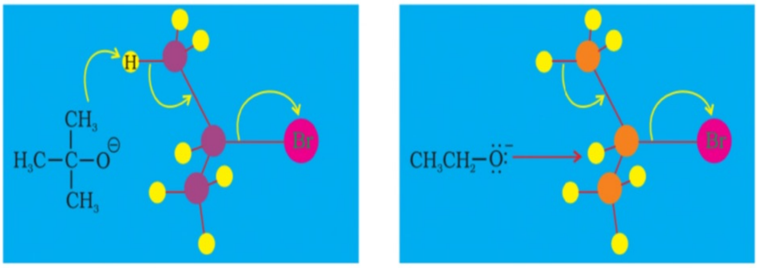
CHIRALITY

An object that cannot be superimposed on its mirror image is called chiral

Reaction of Haloarenes

- Nucleophilic Substitution
- Electrophilic Substitution
- Reaction with metals





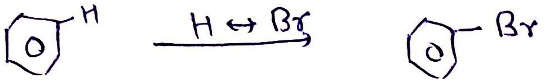
Elimination vs Substitution

Haloalkanes and Haloarenes

→ Aliphatic hydrocarbon $\xrightarrow{H \leftrightarrow X}$ Alkyl halide [haloalkane]

Aromatic hydrocarbon $\xrightarrow[\text{hydrogen by halogen atom}]{\text{Replacement of}}$ Arylhalide [haloarene]

Example-: $CH_4 \xrightarrow{H \leftrightarrow Cl} CH_3Cl$ Methyl chloride



Classification on basis of number of halogen atoms

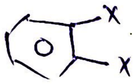
→ If one halogen atom is present in structure of alkanes / arenes : Monohalo alkane / Monohalo arenes

→ If two halogen atoms are present : Dihaloalkane / Dihaloarene

→ Similarly, If three halogen atoms are present : Trihaloalkane / Trihaloarene

Example -: C_2H_5X : Monohaloalkane (X → Halogen)

: Monohaloarene ,



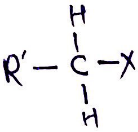
: Dihaloarene

→ **Monohalo compounds**

Compounds containing sp^3 C–X bond

① **Alkyl halides** : (R–X)

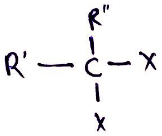
→ Primary Alkyl halide :



$$R'-\overset{H}{\underset{H}{C}}-X$$

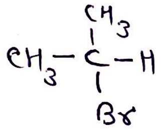
Example-: CH_3-CH_2-Br

→ Secondary (2°) :



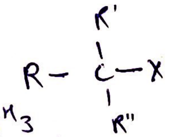
$$R'-\overset{R''}{\underset{X}{C}}-X$$

Example -:



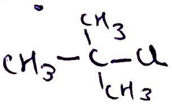
$$CH_3-\overset{CH_3}{\underset{Br}{C}}-H$$

→ Tertiary (3°) :



$$R-\overset{R'}{\underset{R''}{C}}-X$$

Example -:



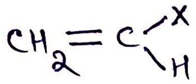
$$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-Cl$$

Compounds containing sp^2 C–X bond

⇓

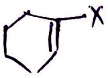
① **Vinylic Halide** :- X is bonded to carbon – carbon double bond.

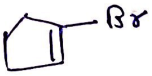
Example -:



$$CH_2=C\begin{smallmatrix}X\\H\end{smallmatrix}$$

,

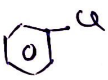




, $CH_3-CH=CBr-CH_3$

② **Aryl halide** -: X (halogen atom) is bonded to the Carbon of aromatic ring (benzene

Example -:



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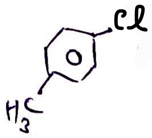
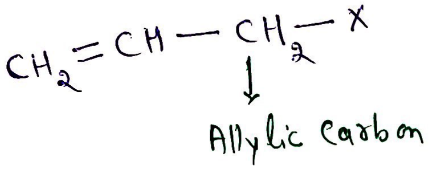


etc.

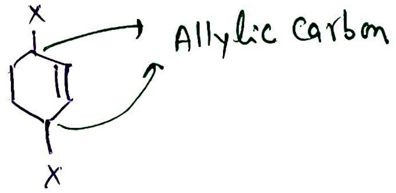
② **Allylic Halides** : X is bonded to sp^3 hybridised carbon atom next to carbon-carbon double bond.

Example -:

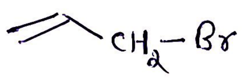


$CH_2=CH-CH_2-X$

Allylic carbon

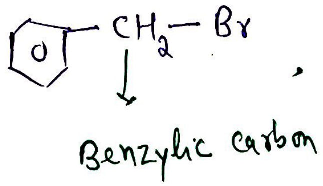


Allyl bromide -:



③ **Benzylic halide** -: Compounds in which the halogen atom is bonded to an sp^3 hybridised carbon atom next to benzene ring.

Example :



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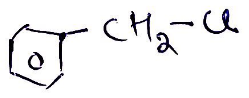
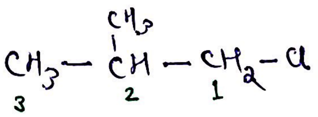


Nomenclature

→ As we know about selection of main chain and numbering of hydrocarbon, same rule is here also (considering halogen atoms (F, Cl, Br, I) as substituents.

→ Rule : No. of carbon > Max. no. of substituent > Lowest set of locants > Alphabetic order

→ Example -: $\overset{3}{C}H_3-\overset{2}{C}H_2-\overset{1}{C}H_2-Br$

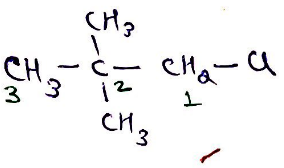


$\underset{3}{CH_3}-\underset{2}{\overset{CH_3}{CH}}-\underset{1}{CH_2}-Cl$

IUPAC → 1-Bromopropane

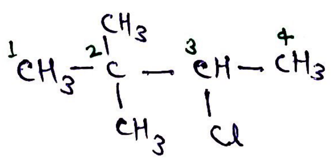
1-Chloro-2-methylpropane

[Delhi 201



$\underset{3}{CH_3}-\overset{CH_3}{\underset{CH_3}{\overset{}{C}}}-\underset{1}{CH_2}-Cl$

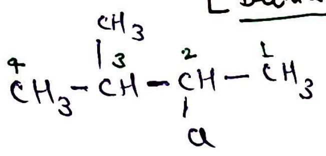
1-Chloro-2,2-dimethylpropane



$\overset{1}{C}H_3-\overset{2}{\underset{CH_3}{\overset{CH_3}{C}}}-\overset{3}{\underset{Cl}{CH}}-\overset{4}{C}H_3$

CBSE [2013]

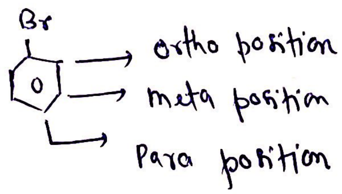
3-chloro-2,2-methylbutane



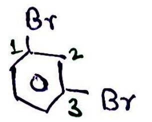
$\overset{4}{C}H_3-\overset{3}{\overset{CH_3}{CH}}-\overset{2}{\underset{Cl}{CH}}-\overset{1}{C}H_3$

2-Chloro-3-methyl butane

→

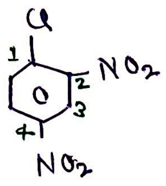


Bromobenzene



Common name : m-Dibromobenzene

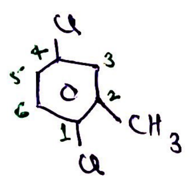
IUPAC : 1,3-Dibromobenzene



Delhi 2017

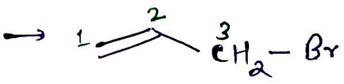
2,4-Dinitro chloro benzene

→



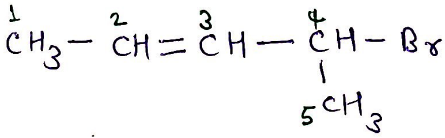
⇒ 1,4-Dichloro-2-methylbenzene

[CBSE 2013]

→ 

[CBSE 2011] (1M)

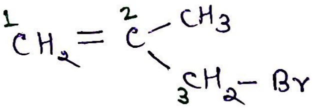
3-Bromopropene



$CH_3-CH=CH-CH(CH_3)-Br$

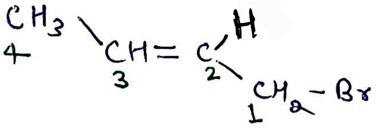
[CBSE 2010] (1M)

4-Bromopent-2-ene



[2010] (1M)

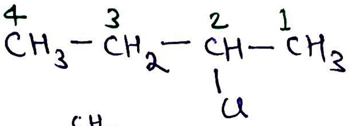
3-Bromo-2-methylpropene



: 1-Bromobut-2-ene

→ Draw the structure of following Compounds?

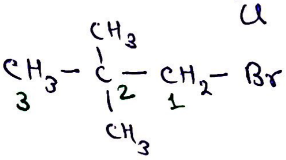
a.] sec-Butyl chloride



$CH_3-CH_2-CH(Cl)-CH_3$

(2-chlorobutane : IUPAC)

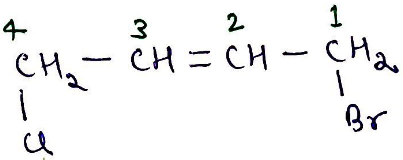
b.] Neo-Pentyl bromide



$CH_3-C(CH_3)_2-CH_2-Br$

(1-Bromo-2,2-dimethylpropane : IUPAC)

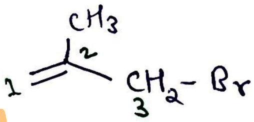
c.] 1-Bromo-4-chloro but-2-ene :



$CH_2(Cl)-CH=CH-CH_2(Br)$

[Delhi 2017] (1M)

d.] 3-Bromo-2-methylprop-1-ene :

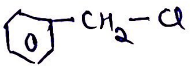


[Delhi 2017] (1M)

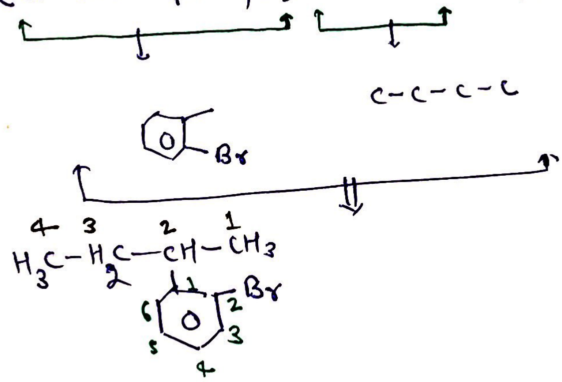
NOTE : Benzene as substituent : Phenyl

Example-: Chloromethyl benzene [x]

Chlorophenylmethane [✓] is correct name of

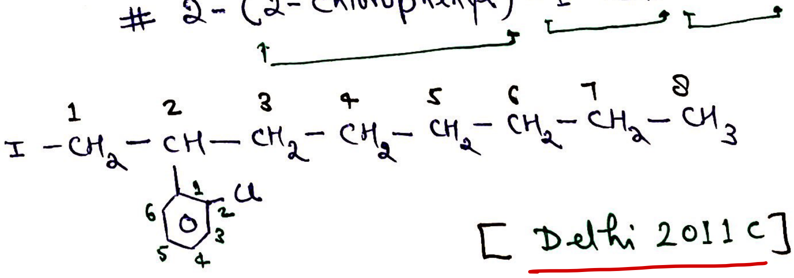


→ 2-(2-bromophenyl) butane [Delhi 2011C] (1M)



c-c-c-c

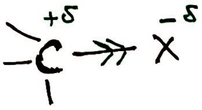
2-(2-chlorophenyl)-1-iodooctane



[Delhi 2011C]

Nature of C−X bond

→ Due to electronegative nature of halogens, c-x bond is polar.



→ size of halogen : I > Br > Cl > F

→ carbon-halogen bond length : C−I > C−Br > C−Cl > C−F

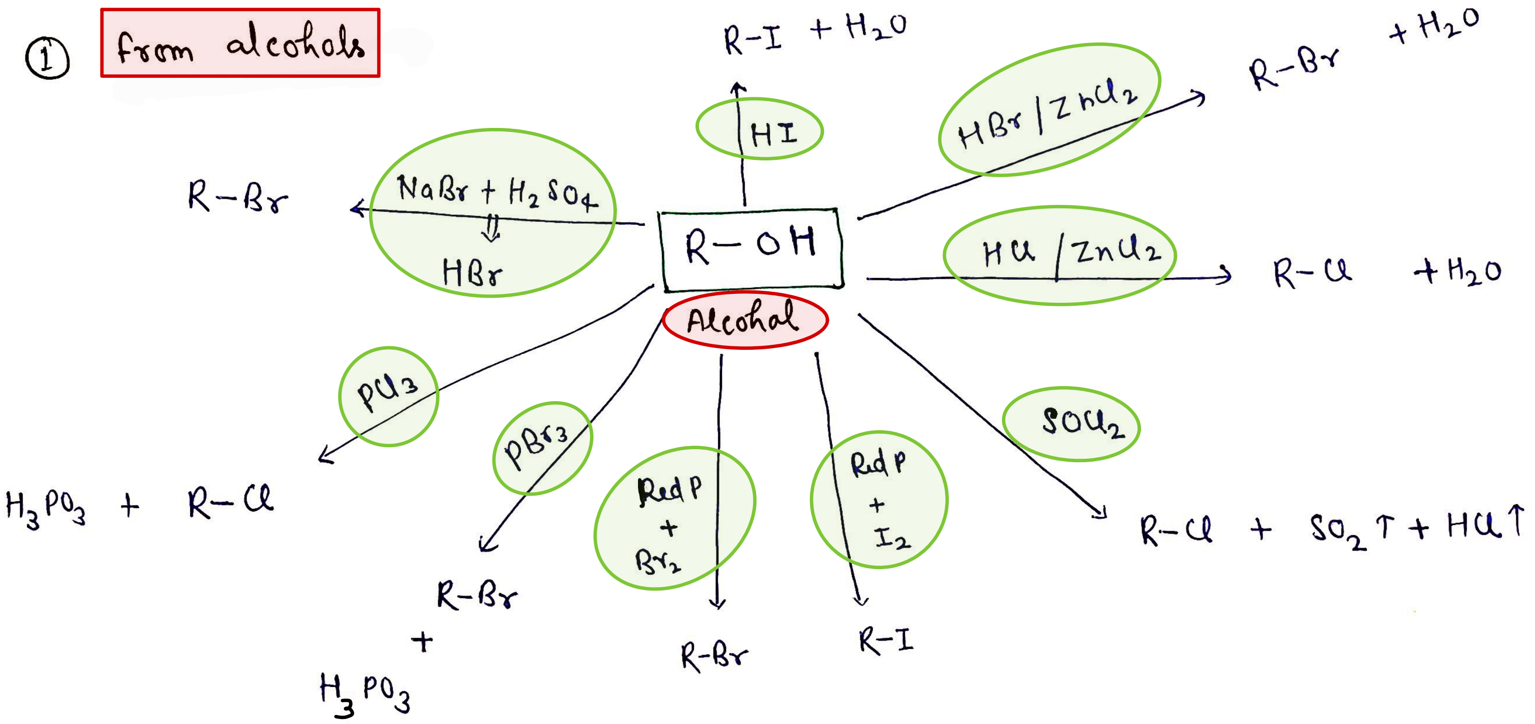
→ Bond Length of C–X ∝ 1/C–X bond enthalpies

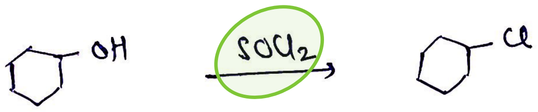
→ **Bond Enthalpy** : C–F > C–Cl > C–Br > C–I

→ **Order of dipole moment** : $CH_3-Cl > CH_3-F > CH_3-Br > CH_3-I$

Methods of preparation

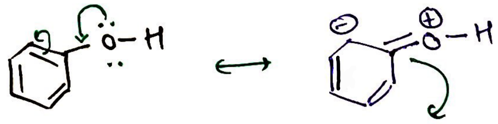
① From alcohols



→ 

[All India 2014] 1M

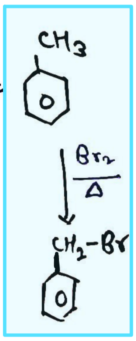
→ Above method is not applicable for the preparation of aryl halides because the carbon – oxygen bond in phenol has partial double bond character.



Breaking of this bond is tough.

2.] From Hydrocarbon

(a) → **Free Radical Halogenation** : $CH_4 \xrightarrow[h\nu]{Cl_2 \text{ (1 equivalent)}} CH_3-Cl + HCl$



$CH_3-CH_3 \xrightarrow[h\nu]{Cl_2 \text{ (1 equivalent)}} CH_3-CH_2-Cl$

$CH_3-CH_2-CH_3 \xrightarrow[\text{UV light}]{Cl_2}$ Only monochloro structural isomers.

$\to CH_3-CH_2-CH_2-Cl$

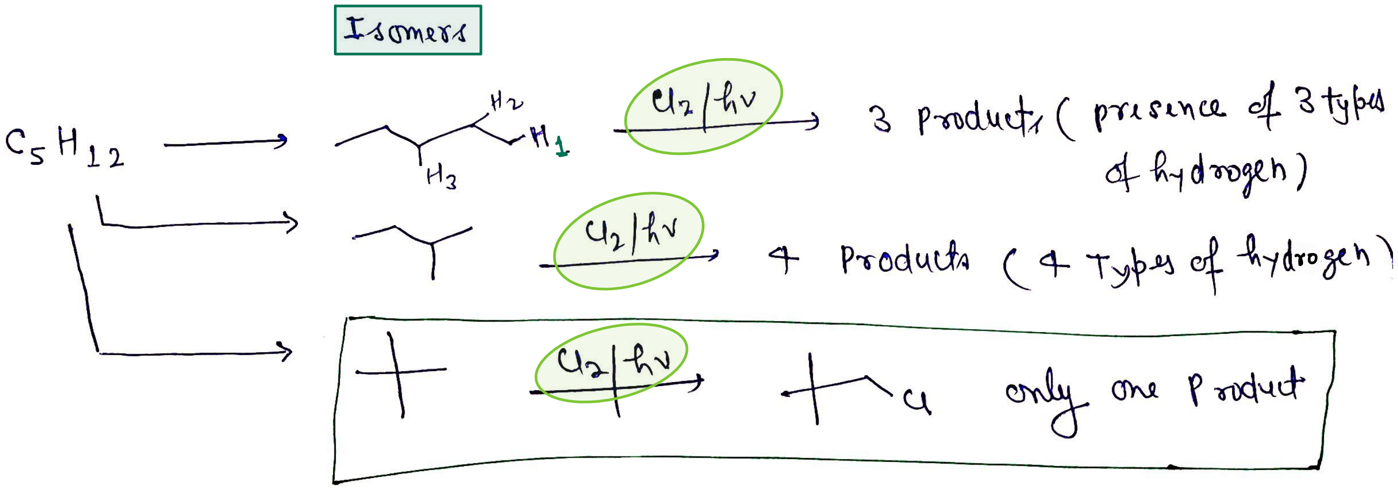
$\to CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$

$\xrightarrow{Cl_2/h\nu}$ Mono, di tri, Poly halo alkanes

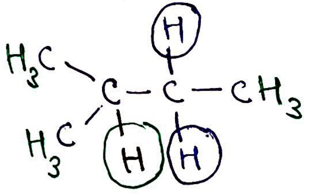
A hydrocarbon C_5H_{12} gives only one monochlorination product. Identify the hydrocarbon.

[Delhi 2013C]

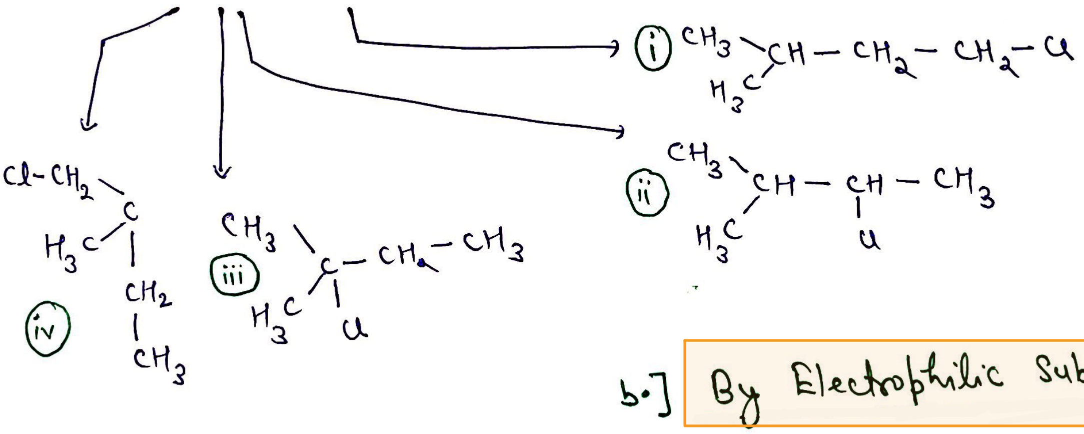
2 M



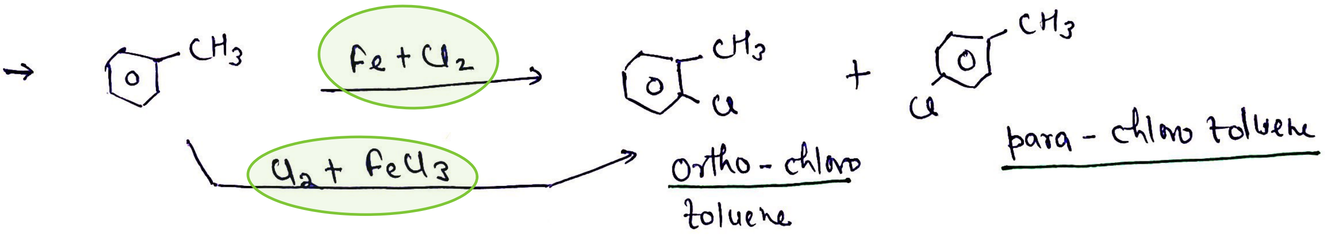
→ Find possible monochloro structural isomers of $(CH_3)_2CH-CH_2-CH_3$.

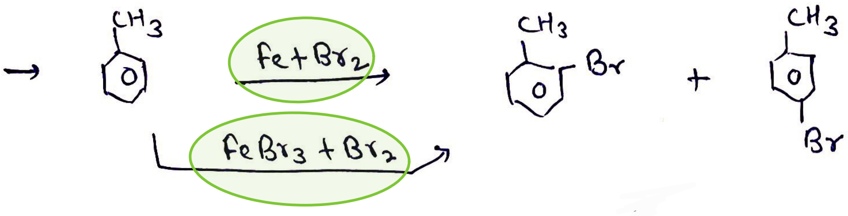


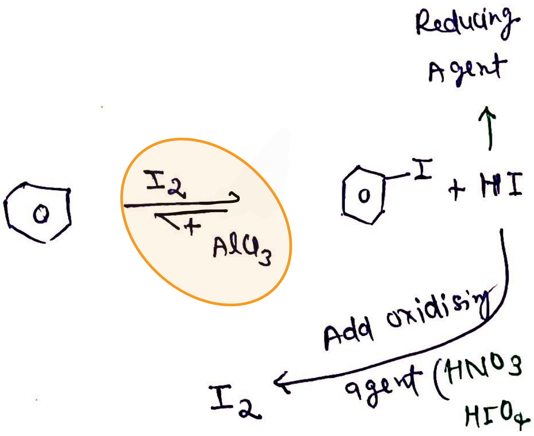
⇒ There are 4 different hydrogens are present. So, by replacing these hydrogen by Chlorine atom we get product



b.] By Electrophilic Substitution :-







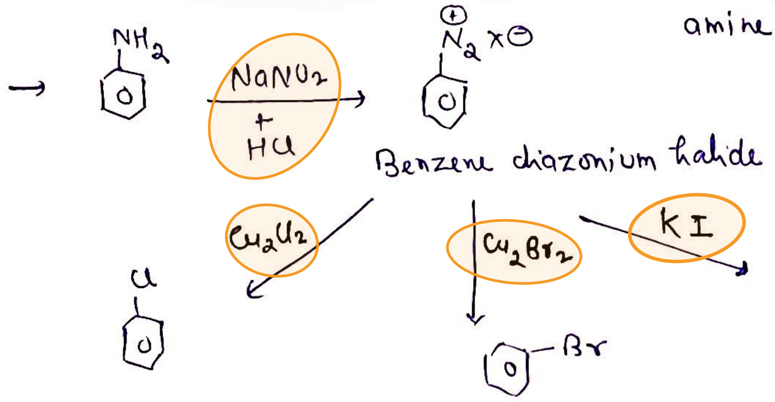
→ Reactions with I_2 are reversible in nature.

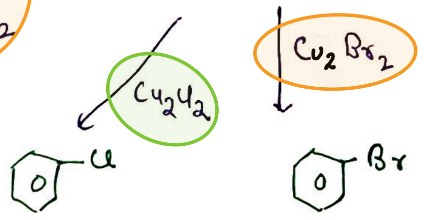
This reaction requires present of oxidising agent to oxidise HI formed during iodonation.

→ Due to high reactivity of flourine (there is probability of explosion) fluoro componds are not prepared by this method.

c.] Sandmeyer's Reaction –:

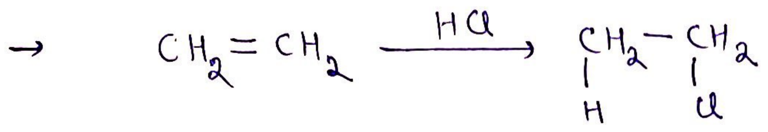
Primary aromatic amine $\xrightarrow[+\ NaNO_2]{HCl}$ Diazonium salt



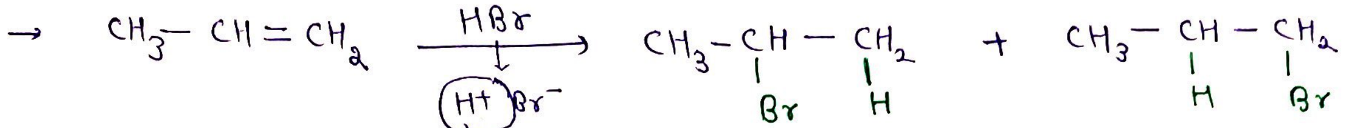


d.] From alkenes –:

ⓘ Addition of hydrogen halide (HCl, HBr, HI ; HF)



$$CH_2=CH_2 \xrightarrow{HCl} \underset{H}{CH_2}-\underset{Cl}{CH_2}$$

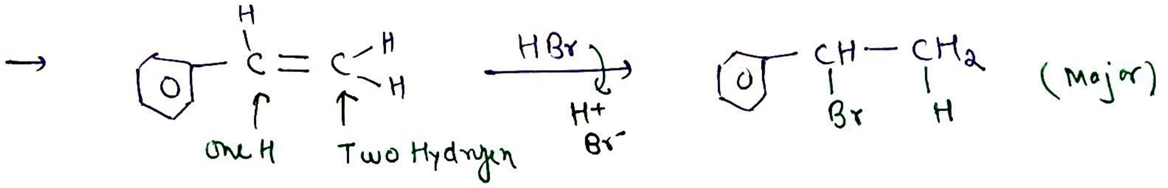


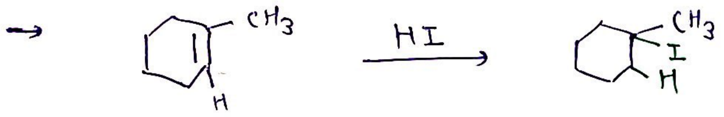
$$CH_3-CH=CH_2 \xrightarrow[H^+\ Br^-]{HBr} CH_3-\underset{Br}{CH}-\underset{H}{CH_2} + CH_3-\underset{H}{CH}-\underset{Br}{CH_2}$$

Major product — Markovnikov's

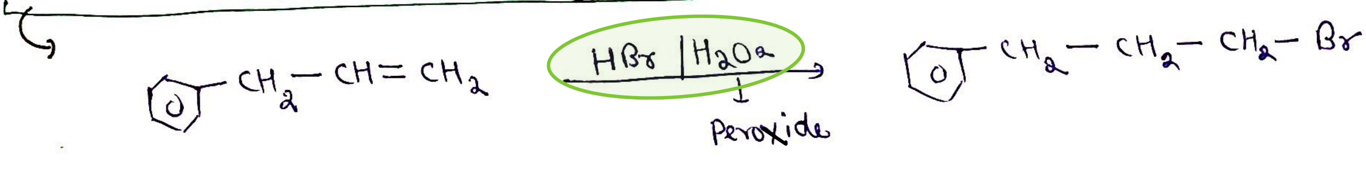
Minor product — Anti - Markovnikov's

Add to that carbon which has more no. of hydrogen. ← Markovnikov's





But in presence of peroxide only addition of HBr ⇒ Anti markovmikov's fashion



ⓘⓘ Addition of halogens (Cl_2, Br_2) –:

$$CH_2=CH_2 \xrightarrow[CCl_4]{Br_2} \begin{matrix} CH_2-Br \\ | \\ CH_2-Br \end{matrix}$$

Finkelstein Reaction ← **Halogen Exchange** → **Swarts Reaction**

$$CH_3-CH_2-Cl \xrightarrow[Acetone]{NaI} CH_3-CH_2-I + NaCl\downarrow$$

$$CH_3-CH_2-Br \xrightarrow[Acetone]{NaI} CH_3-CH_2-I + NaBr\downarrow$$

In Acetone : NaI is soluble but not NaCl / NaBr.

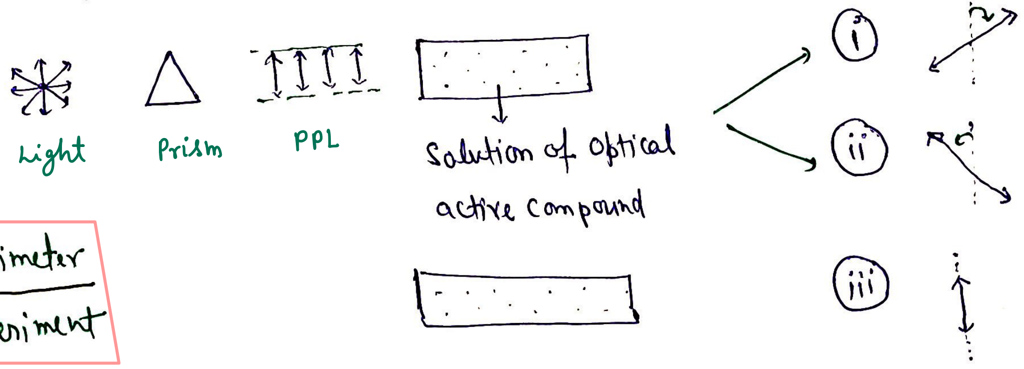
$$CH_3-Br \xrightarrow[AgF / Hg_2F_2 / SbF_3]{Metallic\ fluoride} CH_3-F + AgBr\downarrow$$

In water AgF is soluble but not AgCl / AgBr.

Optical active compound —:

"The compound which can rotate the plane polarised light"

Polarimeter Experiment



Rotation in right direction → dextro-rotatory

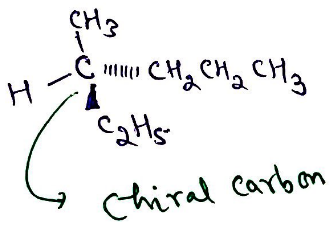
Rotation in left direction → laevo-rotatory

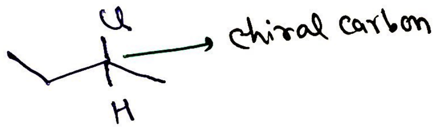
No Rotation → optically inactive

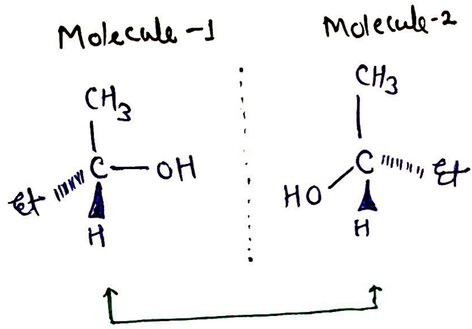
→ dextro-rotatory compound and laevo-rotatory compounds are optical isomers. This phenomenon is known as **optical isomerism**.

→ **Asymmetric Carbon** [chiral carbon] —: sp^3 hybridised carbon attached with 4 different substituents is known as chiral carbon.

→







Non-superimposable mirror images.

⇓

chiral molecule

⇓

Optical active compound.

"molecule having a chiral carbon is always optical active."

→ **Chiral** —: The objects which are non-superimposable on their mirror image are said to be chiral.

→ **Enantiomers** :— Stereoisomers with non-superimposable mirror image character.

→ **Diastereomer** —: Stereoisomers which are not mirror image of each other.

→ In above example molecule-1 & molecule-2 are enantiomer of eachother as they are non-superimposable mirror images.

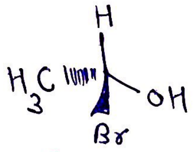
→ **Racemic mix** —: A mixture containing two enantiomers in equal proportions is known as racemic mixture.

→ It is represented by dl or (±).

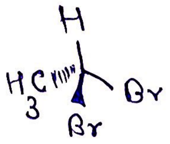
→ The process of forming racemic mixture is known as **racemisation**.

Question :— Identify chiral and achiral molecule —:

a.]

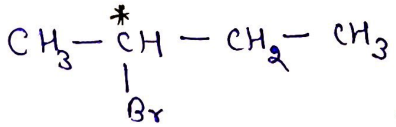


Chiral



Achiral

b.]



$CH_3-\overset{*}{C}H(Br)-CH_2-CH_3$

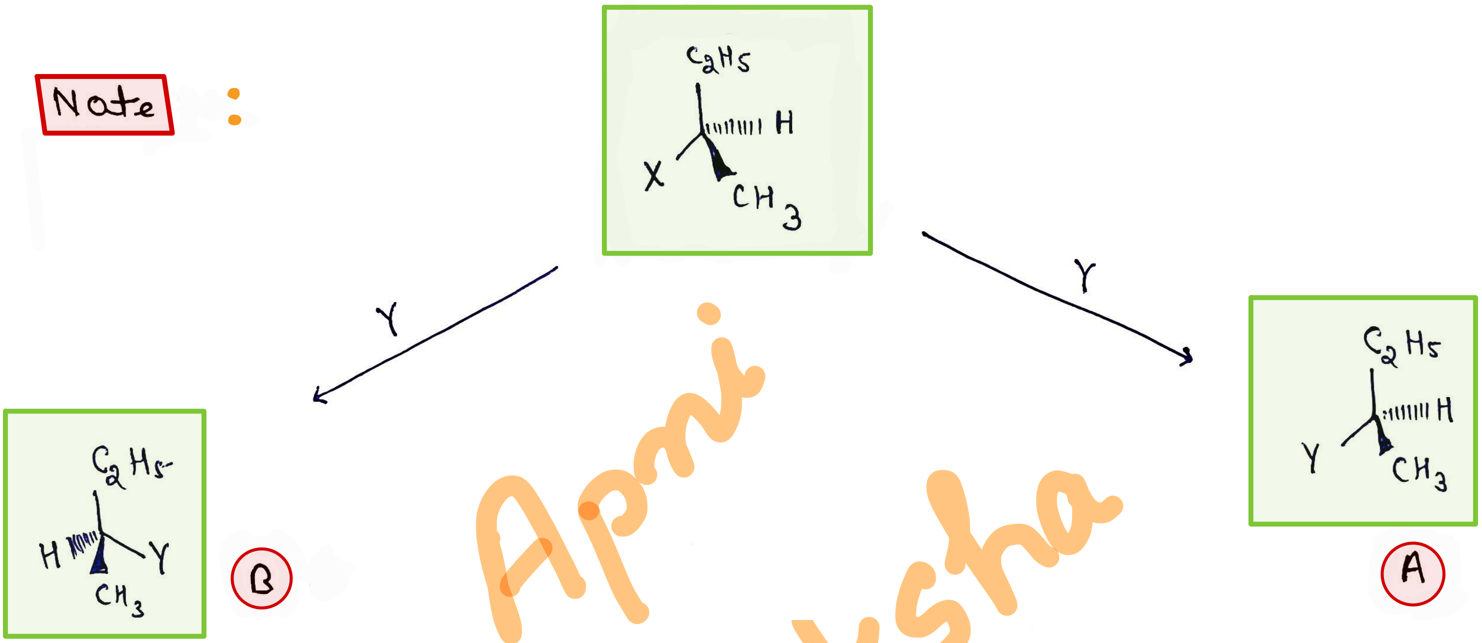
one chiral carbon
⇓
Optical Active

Chiral

$CH_3-CH_2-CH_2-CH_2-Br$

↳ Achiral

Note :



→ **Retention** :— If A is the only product in reaction. Then this process is called retention.

→ **Inversion** :— If B is the only product in reaction, then this process is called inversion.

→ **Racemisation** —: If A and B both are 50% then this process is called racemisation. And mixture of A+B : Racemic mixture.

→ Mixture of A and B with 50 - 50% concentration is optically inactive. As one isomer will rotate light in the direction opposite to another.

Physical Properties

B.P. & M.P.

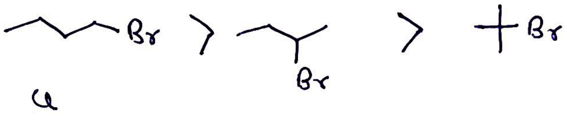
→ Molecules of organic halogen compounds are generally polar, due to greater polarity as well as higher molecular mass as compared to parent hydrocarbon, the dipole - dipole and van der Waals force of attraction are stronger in halogen derivatives.

So. B.P. : Halogen Derivative compound > Parent hydrocarbon.

→ For a given halogen atom —: B.P. :

→ For a given alkyl group —: B.P. : R–I > R–Br > R–Cl > R–F

→ $B.P. \propto \frac{1}{\text{Branching}}$ —: B.P. :



→ Melting point : [CBSE 2019] (1M)

: Due to symmetry of para isomer that fits in crystal lattice better as ortho/me

Solubility :— The solubility of haloalkanes in water is low. Because force of attraction between haloalkanes is greater than haloalkanes - water interaction.

Chemical Reactions of Haloalkanes

Nucleophilic substitution Reaction

Elimination Reaction

Reaction with metals

Nucleophilic substitution Reaction —:

$$Nu^{\ominus} + \overset{+\delta}{C}H_3 \rightarrow \overset{-\delta}{X} \longrightarrow Nu-CH_3 + X^{\ominus}$$

Nucleophile Alkyl halide Product Leaving group

Nucleophile ↓ Nucleus loving species (+ve charge loving)

In this reaction, substitution reaction is initiated by a nucleophile so, it is called NSR.

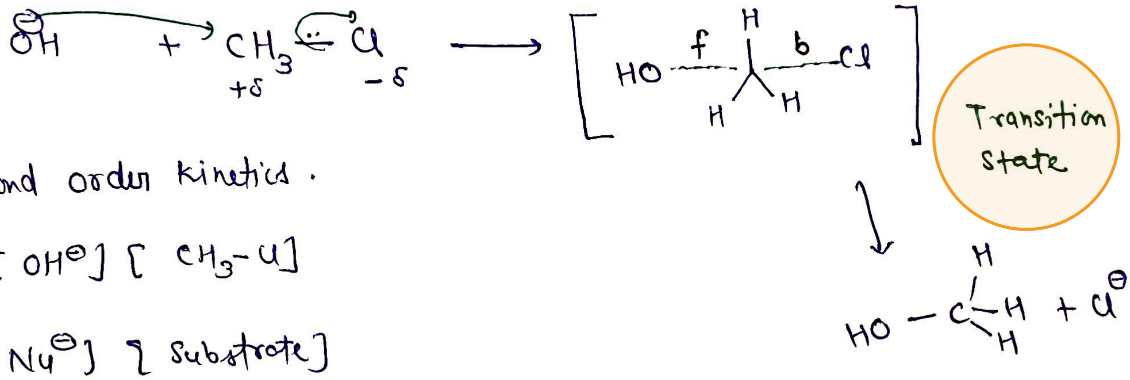
→ Two different mechanisms can explain above reaction → S_N2, S_N1

i Bimolecular Nucleophilic Substitution —: S_N2

$\underbrace{\text{Bimolecular}}_{2}$ $\underbrace{\text{Nucleophilic}}_{N}$ $\underbrace{\text{Substitution}}_{S}$

Consider a reaction : $HO^{\ominus} + H_3C-Cl \longrightarrow HO-CH_3 + Cl^{\ominus}$

Mechanism -:



$$\overset{\ominus}{O}H + \overset{+\delta}{CH_3}-\overset{-\delta}{Cl} \longrightarrow [HO \cdots CH_3 \cdots Cl] \longrightarrow HO-CH_3 + Cl^{\ominus}$$

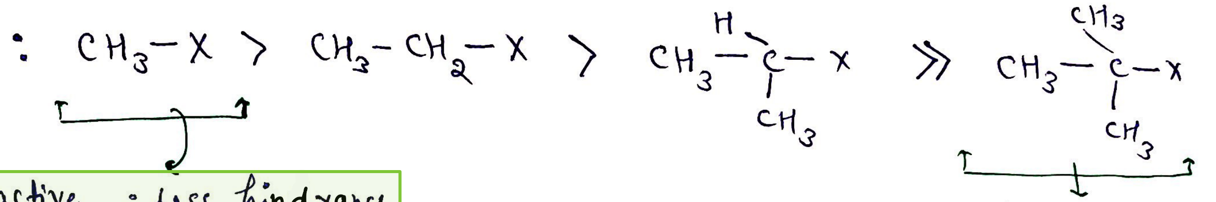
→ It follows second order kinetics.

Rate $= K[OH^{\ominus}][CH_3-Cl]$

Rate $\propto [Nu^{\ominus}][\text{substrate}]$

→ It is a single step (Concerted) reaction.

→ Order of reactivity : Primary halide > secondary halide >> Tertiary halide



: $CH_3-X > CH_3-CH_2-X > CH_3-\underset{CH_3}{\overset{H}{C}}-X \gg CH_3-\underset{CH_3}{\overset{CH_3}{C}}-X$

Most reactive : Less hindrance

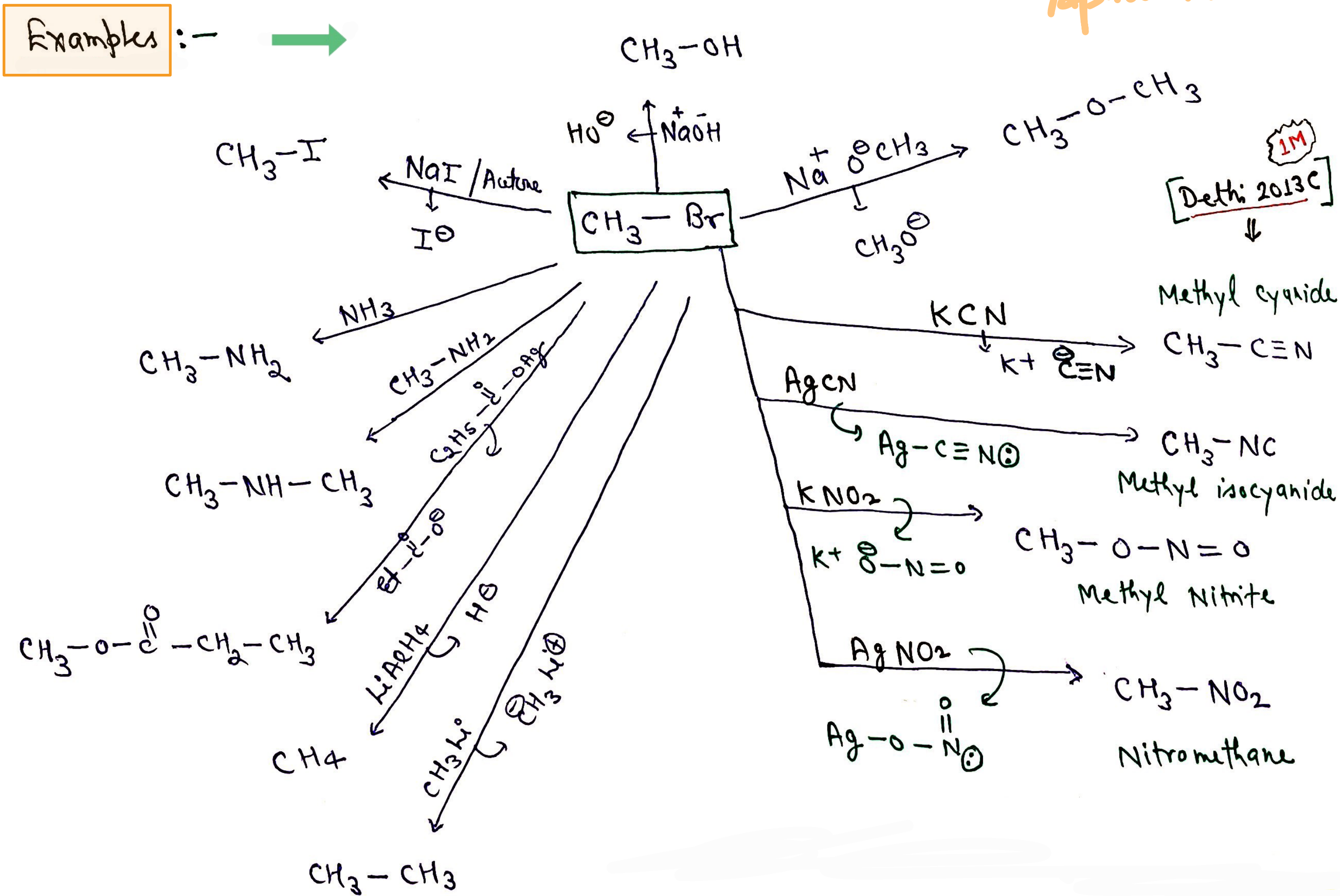
Least reactive because bulky groups hinder the approaching of nucleophiles towards carbon.

→ Order of reactivity with different halogen atoms : $R-I > R-Br > R-Cl > R-F$

$R-I$ → Weak Bond strength So, easy to break.

$R-F$ → Strong Bond, So tough to break.

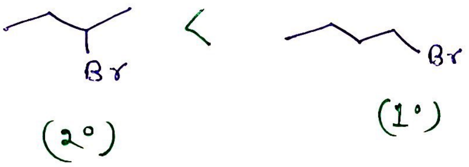
Examples :-



→ Substrate having less crowding is more effective than more crowding substrate for S_N2 reaction.

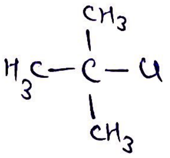
Example -:

Rate of reaction :



→ [CBSE 2019] 1M

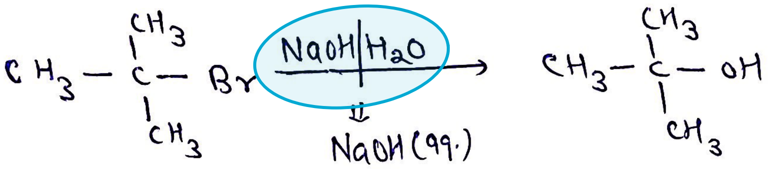
: CH_3-I > CH_3-Br

: 

$H_3C-C(CH_3)_2-Cl$ < CH_3-Cl

[Delhi 2014
CBSE 2014
CBSE 2010] 1M

Unimolecular Substitution nucleophilic reaction : S_N1

→ 

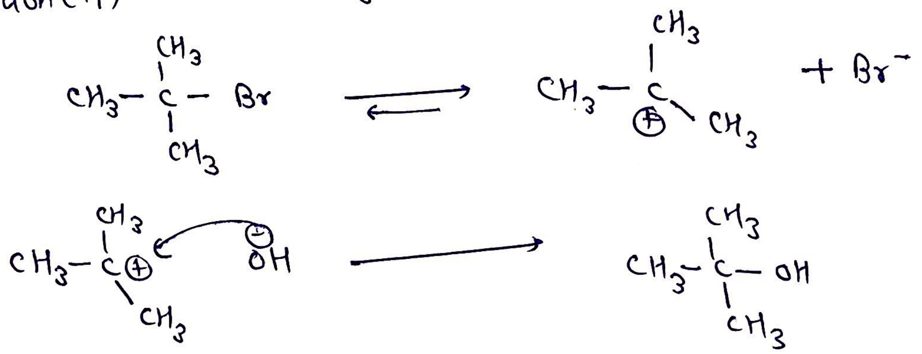
$CH_3-C(CH_3)_2-Br \xrightarrow{NaOH/H_2O} CH_3-C(CH_3)_2-OH$

NaOH (aq.)

Mechanism -:

Step (i)

step (ii)



$CH_3-C(CH_3)_2-Br \rightleftharpoons CH_3-\overset{\oplus}{C}(CH_3)_2 + Br^-$

$CH_3-\overset{\oplus}{C}(CH_3)_2 + \overset{\ominus}{O}H \longrightarrow CH_3-C(CH_3)_2-OH$

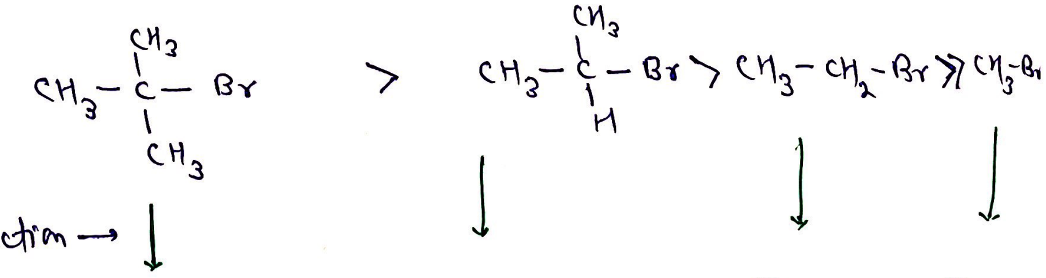
→ Above reaction follows first order kinetics.

Rate ∝ [Alkyl halide]

→ It is a two step reaction and carbocation reaction intermidiate is formed.

→ Step (i) is slow and reversible & Rate of reaction depends on slowest step.

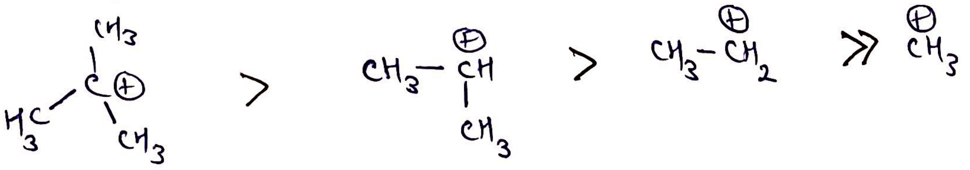
Order of reactivity :



$CH_3-C(CH_3)_2-Br > CH_3-CH(CH_3)-Br > CH_3-CH_2-Br \gg CH_3-Br$

During reaction →

Stability of Carbocation :

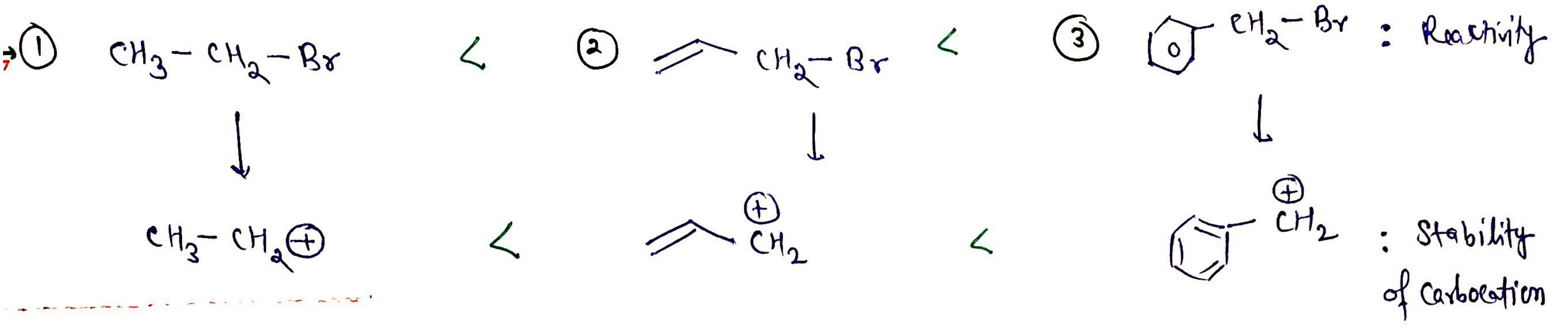


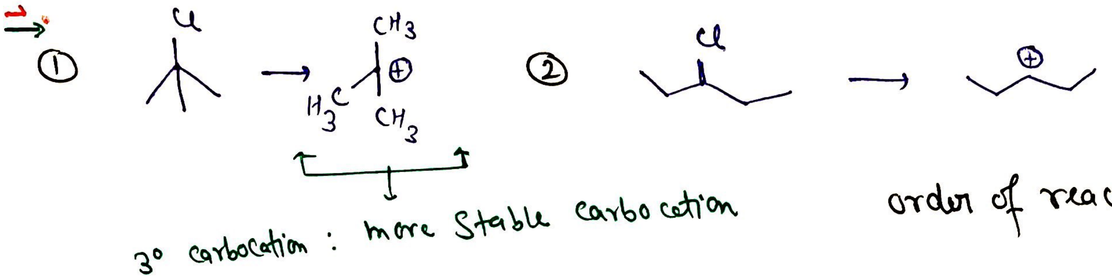
$H_3C-\overset{\oplus}{C}(CH_3)_2 > CH_3-\overset{\oplus}{C}H-CH_3 > CH_3-\overset{\oplus}{C}H_2 \gg \overset{\oplus}{C}H_3$

→ If carbocation intermidiate is stable then that substrate gives fast S_N1 reaction

→ **Order of reactivity** : R–I > R–Br > R–Cl > R–F

→ Find the order of reactivity for SN1 reaction ?





[Delhi 2013] 1M

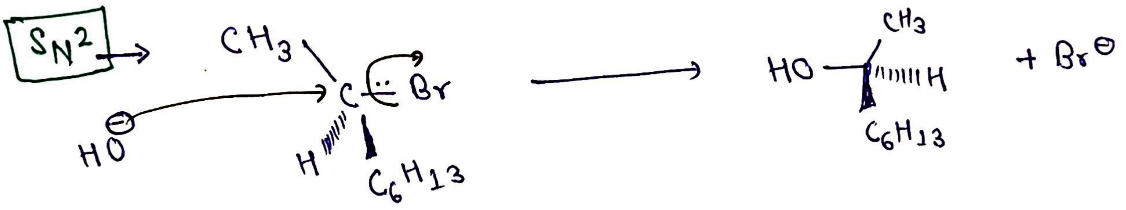
order of reactivity : ① > ②

Stereochemistry of S_N1 vs S_N2 –:

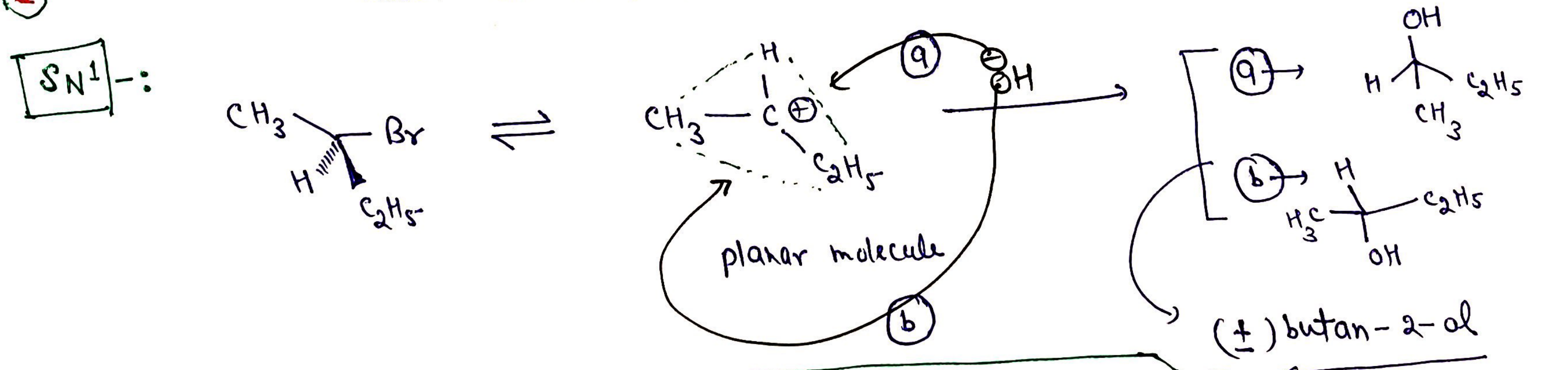
S_N2 reaction gives inverted product.

But SN1 reaction gives racemic mixture (It go through racemisation)

Example –:



$\overset{\ominus}{O}H$ attacks on the opposite side of carbon – bromine bond. So inversion of configuration happens.



order of reactivity for S_N1 : tert. Halide > sec. Halide > 1° Halide > CH_3-X

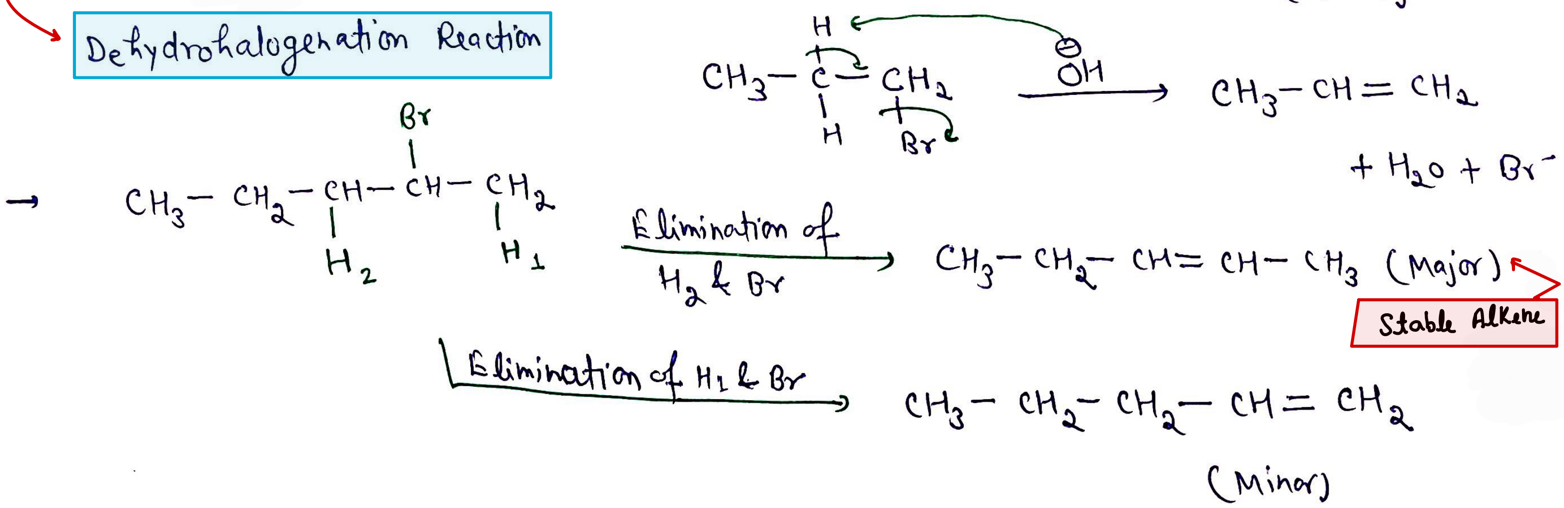
for S_N2 : CH_3-X > 1° Halide > sec. Halide >> ter Halide

→ S_N1 : $(CH_3)_3CBr > CH_3-CH(Br)-CH_2-CH_3 > CH_3-CH_2-CH_2-CH_2-Br$

S_N2 : $(CH_3)_3CBr > CH_3-CH(Br)-CH_2-CH_3 > CH_3-CH_2-CH_2-CH_2-Br$

Elimination Reaction —: Haloalkane with β-hydrogen atom $\xrightarrow[\text{(alcoholic)}]{KOH}$ Alkene

Dehydrohalogenation Reaction



$CH_3-CH_2-CH_2Br \xrightarrow{\overset{\ominus}{O}H} CH_3-CH=CH_2 + H_2O + Br^-$

→ $CH_3-CH_2-CH(H_2)-CH(Br)-CH_2(H_1)$ $\xrightarrow[H_2\ \&\ Br]{\text{Elimination of}}$ $CH_3-CH_2-CH=CH-CH_3$ (Major) ← Stable Alkene

$\xrightarrow{\text{Elimination of } H_1\ \&\ Br}$ $CH_3-CH_2-CH_2-CH=CH_2$ (Minor)

Reaction with metals —: $R-Br \xrightarrow[\text{Dry ether}]{Mg} R-Mg-X$ [Grignard Reagent]

\# $R-MgX \xrightarrow[H^+\ \overline{O}H]{H_2O} R-H$

⇓

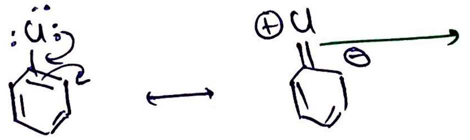
$R^{\ominus}\ \overset{\oplus}{Mg}X$

\# $R\boxed{-X + Na + X-}R \longrightarrow R-R + NaX$

Reactions of haloarenes

Nucleophilic Substitution —: Aryl halides are extremely less reactive toward NSR due to following reasons —: [Delhi 2013] (2M)

(i) Resonance effect —: [Delhi 2013] (1M)

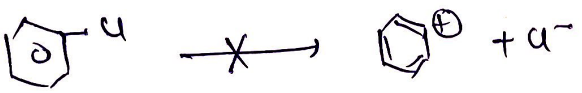


C–Cl bond acquires a partial double bond character due to resonance as a result bond breaking in haloarene is difficult than haloalkane. Therefore haloarenes are less reactive than haloalkane towards NSR.

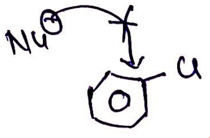
CH_3-Cl

↳ Always single bond character

(ii) Instability of phenyl cation —: Haloarenes can not follow S_N1 path because during first step we get phenyl cation which is not stable.

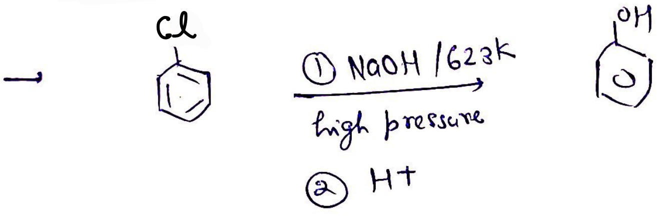


(iii) Because of possible repulsion, it is less likely for electron rich nucleophile to approach electron rich arenes.



Apni Kaksha

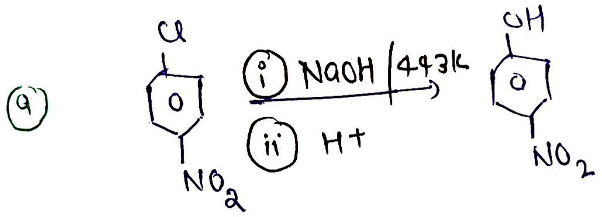
→ Replacement by hydroxyl group :-



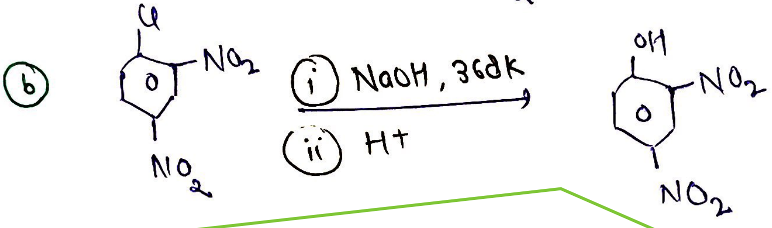
The presence of an electron withdrawing group (–NO_2 / –CN) at ortho and para positions increases the reactivity of halo-arenes.

[Delhi 2019] 1M

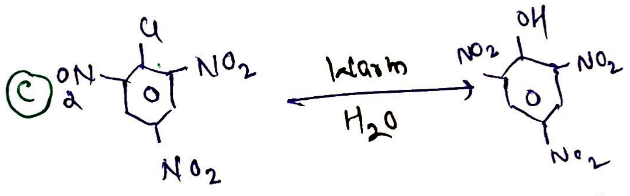
(a)



(b)



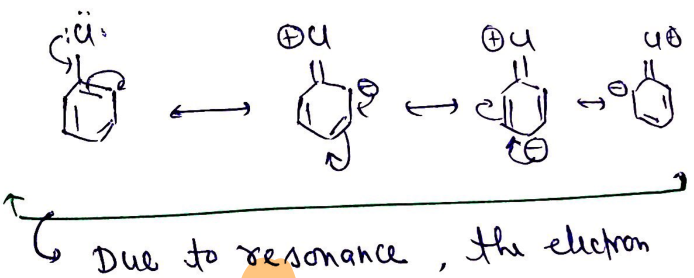
(c)



Picric acid

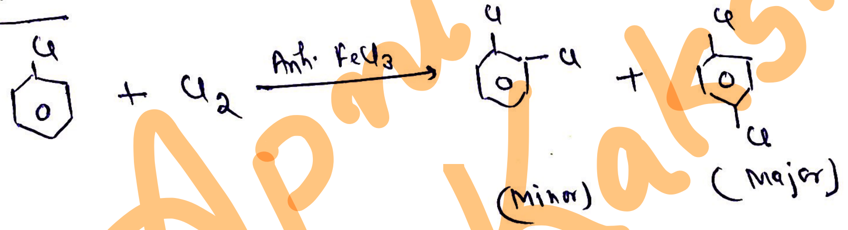
Electrophilic Substitution Reaction -:

→ Halogens are ortho – para directing in nature for ESR. [Delhi 2012] 3M



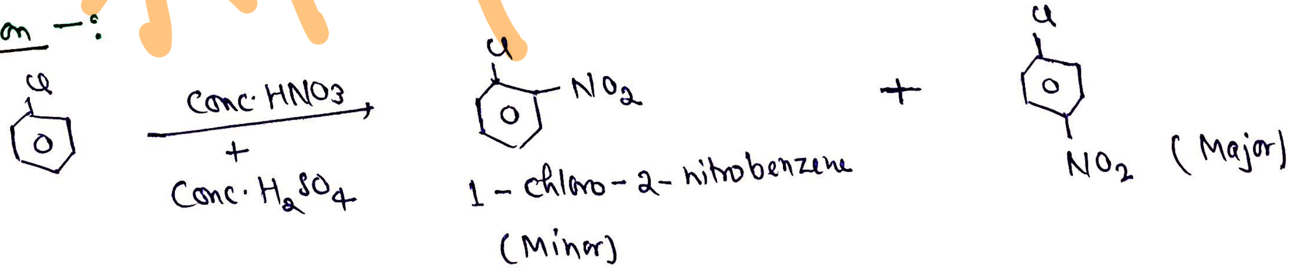
Due to resonance, the electron density increases more at ortho and para position.

(i) Halogenation :-

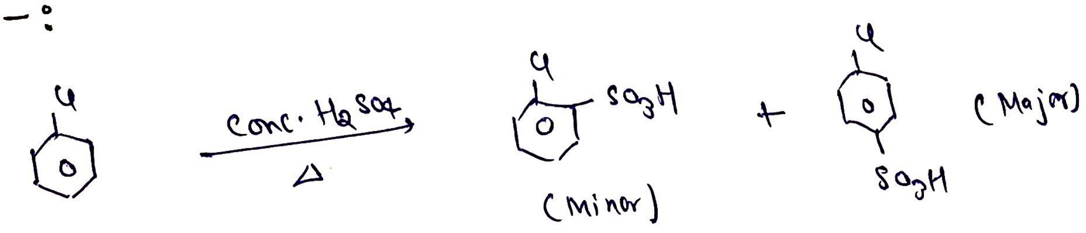


→ [CBSE 2015] 1M

(ii) Nitration -:



(iii) Sulphonation -:



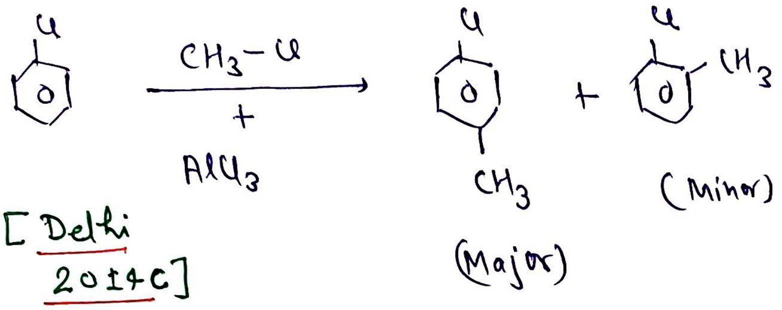
(iv)

Friedel - craft's Reaction

[Delhi 2010] 1M

Alkylation

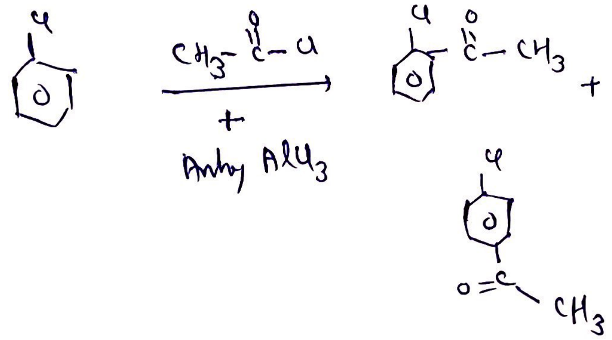
Addition of alkyl group on benzene



[Delhi 2014C] 1M

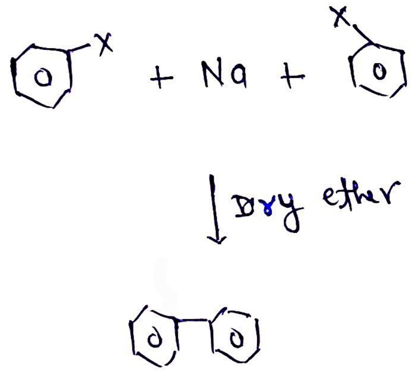
Acylation

Addition of acyl group on benzene

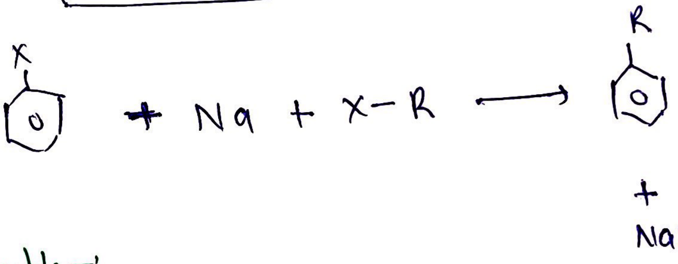


Reaction with metal :-

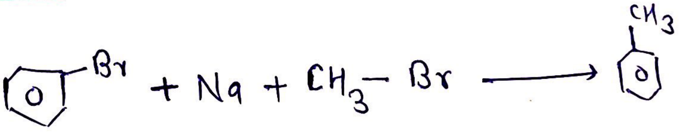
Fittig Reaction



Wurtz - Fittig Reaction



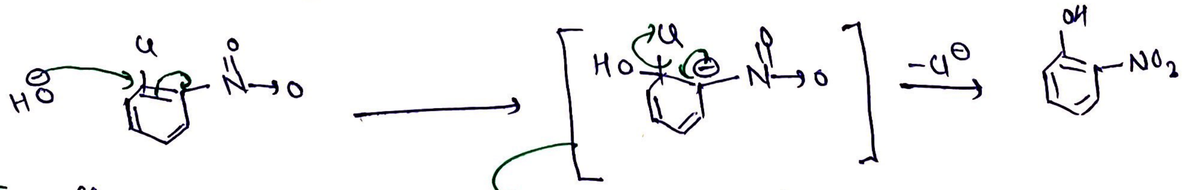
Example -:

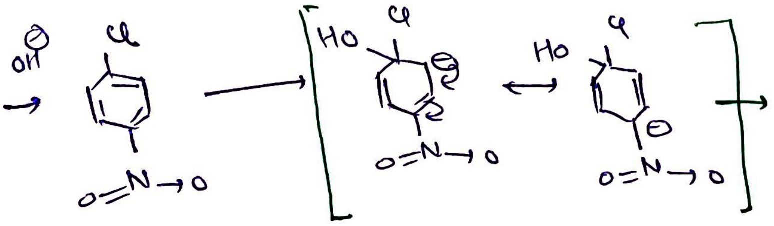


Question :- The presence of nitro group at ortho-para positions increase the reactivity of haloarenes towards NSR, Why? [CBSE 2019] 1M

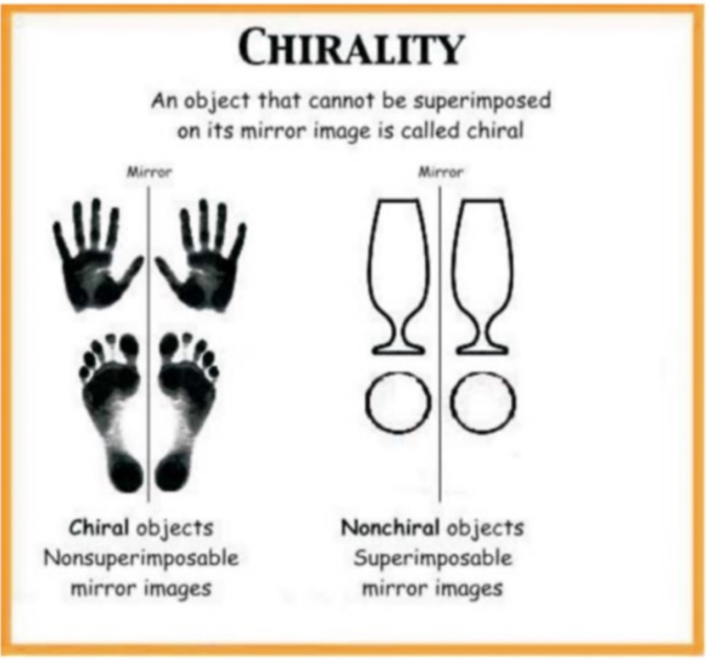
Answer -: Because $-NO_2$ group at ortho and para positions withdraw electron density from the benzene ring and thus facilitates the nucleophilic attack on haloarenes.

Mechanism -:



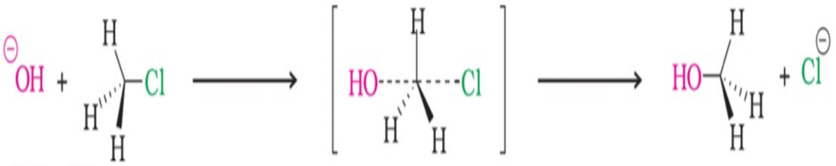


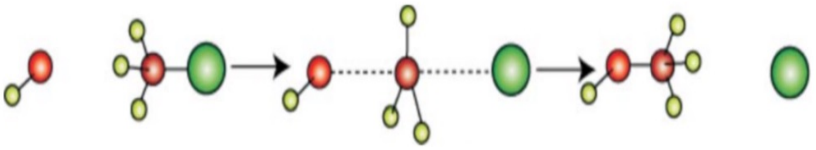
This anion is stable due to inductive and resonance (mesomeric) -M effect of $-NO_2$.



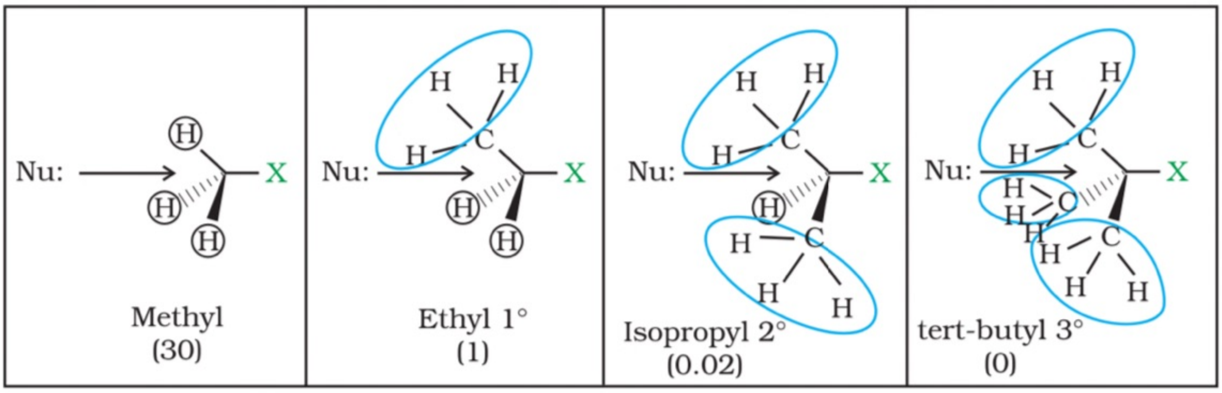
Some common examples of chiral and achiral objects

SN^2 Reaction





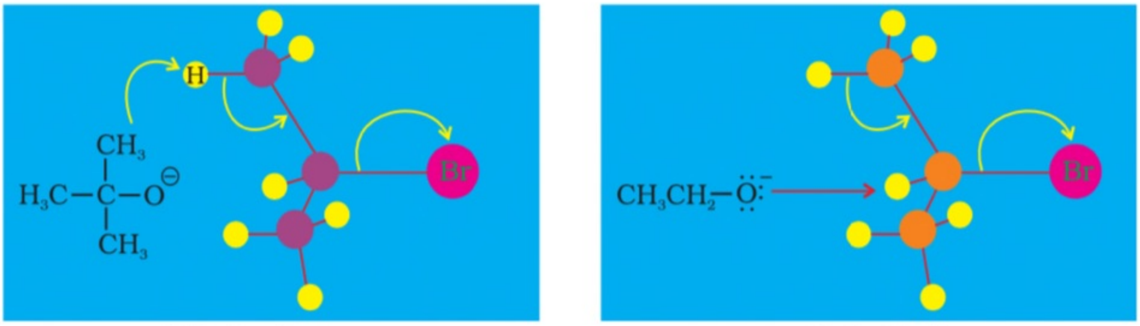
Red dot represents the incoming hydroxide ion and green dot represents the outgoing halide ion



Steric effects in S_N2 reaction. The relative rate of S_N2 reaction is given in parenthesis

Elimination versus substitution

A chemical reaction is the result of competition; it is a race that is won by the fastest runner. A collection of molecules tend to do, by and large, what is easiest for them. An alkyl halide with α-hydrogen atoms when reacted with a base or a nucleophile has two competing routes: substitution (S_N1 and S_N2) and elimination. Which route will be taken up depends upon the nature of alkyl halide, strength and size of base/nucleophile and reaction conditions. Thus, a bulkier nucleophile will prefer to act as a base and abstracts a proton rather than approach a tetravalent carbon atom (steric reasons) and *vice versa*. Similarly, a primary alkyl halide will prefer a S_N2 reaction, a secondary halide- S_N2 or elimination depending upon the strength of base/nucleophile and a tertiary halide- S_N1 or elimination depending upon the stability of carbocation or the more substituted alkene.



Elimination *vs* Substitution