2 April 24

Halo (Halogen)

F > Cl > Br > I

Alkanes

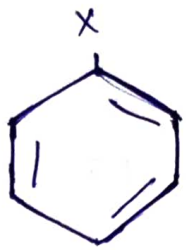
R → CH_3 – Alkanes

$CH_2 = CH$ – Alkenes

$CH \equiv C$ – Alkynes.

Arenes

Benzene.



* Classification of Haloalkanes & Haloarenes :-

↳ On the basis of no. of halogens.

(Haloalkanes)

① Monohaloalkanes. (1 halogen R.) Ex: $CH_3 - Cl$.

$CH_3 - CH_2 - Cl$.

② Dihaloalkanes (2 halogen)

(a) Gem halide
C पे 2 halo.

Ex:
$CH_2 - Cl$
|
Cl

(b) Vicinal dihalide
पड़ोसी C पे 2 halo.

Ex: $CH_2 - CH_2$
| |
Cl Cl

(c) α, ω dihalide.
α, ω पे halo.

Ex:
α β γ ω
$CH_2 - CH_2 - CH_2 - CH_2 - CH_3$
|
Cl

③ Trihaloalkane (3 halogen).

$CH_2 - CH - CH_2$
| | |
X X X

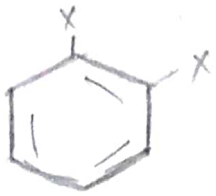
(Haloarenes)

(1) Monohalarenes.

Ex.:

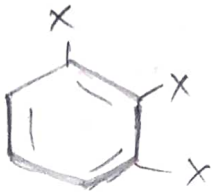
(2) Dihalo arenes.

Ex:



(3) Trihalo arenes.

Ex:



↳ On the basis of sp_3 Carbon :-

Alkyl

1° Halo alkane

$CH_3 - CH_2 - X$ (Primary)

2° Haloalkane.

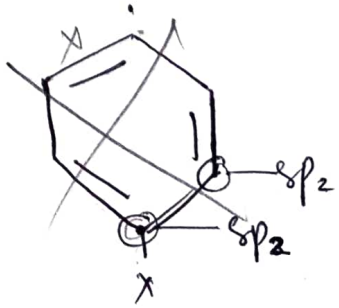
$CH_3 - \underset{\underset{CH_3}{|}}{CH} - X$ (Secondary)

3° Haloalkane.

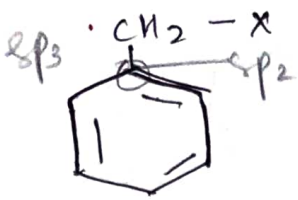
$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - X$ (Tertiary)

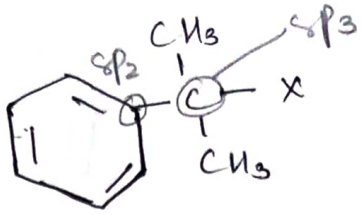
Allylic Halide

$CH_3 = \underset{sp_2}{CH} - \underset{sp_3}{CH_2} - X$



Benzyllic





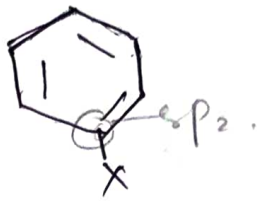
↳ On the basic of sp^2 Carbon :-

Vinylic group

$CH_2 = CH_2 - X$

sp^2

Aryl group.



(Benzene).

ISOMERISM.

- Chain
- Position.

(1) Chain Isomer : C_4.

$C-C-C-C$ = Butane.

$C-\underset{\underset{C}{|}}{C}-C$ = 2 - Meth - Propane.

(2) Position Isomer : $C_5 H_{11} Br$.

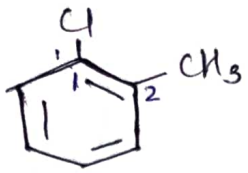
$C-C-C-C-C-Br$ = 1 Bromo Pentane
1°

$C-C-C-\underset{\underset{Br}{|}}{C}-C$ = 2 Bromo pentane.
2°.

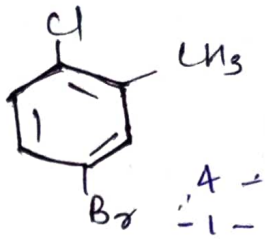
$C-\overset{\beta}{C}-\underset{\underset{Br}{|}}{\overset{\alpha}{C}}-\overset{\beta}{C}-C$ = 3 Bromo Pentane.
2°.

IUPAC Name of cyclic / Aromatic.

Chloro Benzene



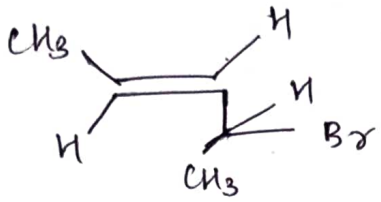
1-chloro-2-Methyl Benze.



4-Bromo-1-Chloro 2-Methyl Benzene.

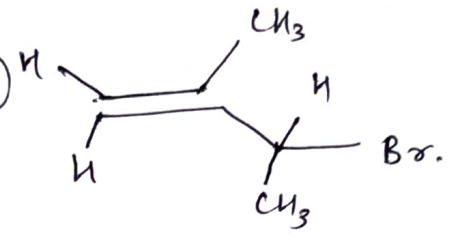
Example:

(1)



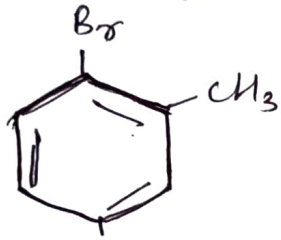
4 Bromo pent-2-ene

(2)



3-Bromo-2-Methyl but-1-ene.

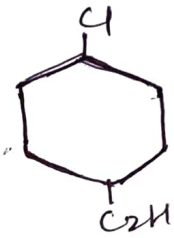
(3)



$CH_3-CH_2-\underset{CH_3}{\overset{}{C}}-CH_3$

1 Bromo-4 Sec-butyl-2-methyl benzene.

(4)



1 Chloro-4-ethyl cyclo hexane.

METHOD OF PREPRATION.

(1) From Alcohol. R-OH · Ex: CH_3-CH_2-OH

(a) From Lucas Reagent ($ZnCl_2$ / HCl)

$$CH_3-CH_2-OH + HCl \xrightarrow{ZnCl_2} CH_3-CH_2-Cl + H_2O$$

(b) From $NaBr + H_2SO_4$ (पानी निकालना)

$$CH_3-CH_2-OH + NaBr + H_2SO_4 \longrightarrow CH_3-CH_2-Br + H-HSO_4 + H_2O + NaHSO_4$$

*Phosphorus(P) non metal oxide are acidic.

(c) From PCl_3

$$CH_3-CH_2-OH + PCl_3 \longrightarrow CH_3-CH_2-Cl + H_3PO_3$$

(Ph less than 7) ← ortho phosphorous acid.

(d) Rxn with PCl_5

$$CH_3-CH_2-OH + PCl_5 \longrightarrow CH_3-CH_2-Cl + HCl + POCl_3$$

(acidic)

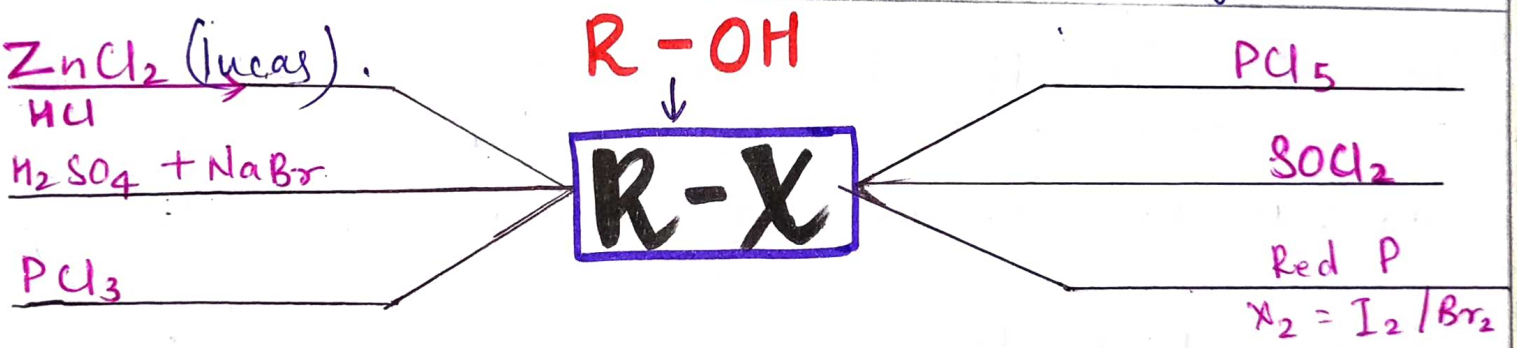
(e) Rxn with Red P / X_2 Br_2 or I_2.

$$CH_3-CH_2-OH \xrightarrow[X_2 = I_2/Br_2]{\text{Red P}} CH_3-CH_2-I \text{ or } CH_3-CH_2-Br$$

(f) Rxn with $SOCl_2$. (Best Method)

Sulphonyl / Thionyl chloride.

$$CH_3-CH_2-OH + SOCl_2 \longrightarrow CH_3-CH_2-Cl + SO_{2(g)}\uparrow + HCl_{(g)}\uparrow$$



NATURE OF R-X BOND.

X = Halogen.

$$-\overset{+\delta}{C}-\overset{-\delta}{C}$$ more EN.

= Polar.

R-X bond are polar in nature because halogens are highly electro negative (EN).

Note : $R-OH + \xrightarrow[\text{Lucas Reagent.}]{ZnCl_2 / HCl}$

★ Lucas Reagent shows the turbidity test of alcohol.

1° Alc. + $\xrightarrow[HCl]{ZnCl_2}$ Turbidity while heating.

2° Alc. + $\xrightarrow[\text{Reagent}]{\text{Lucas}}$ Turbidity after 15 min.

3° Alc. + $\xrightarrow[\text{Reagent}]{\text{Lucas}}$ Turbidity ~~after~~ immediately.

Reactivity order of Alcohol:

$3^\circ > 2^\circ > 1^\circ$

Note : The PH of system decreases when R-OH react with PCl_3 / PCl_5 / Red P.

Reason: Due to the formation of H_3PO_3 or H_3PO_4.

Note : Best Method for making R-X from R-OH are $SOCl_2$ (sulfuryl chloride) Due to all the biproducts are in gaseous from (HCl, SO_2) which is eleminated.

(2) From Alkanes:

Mono Chloro derivative = 1 Cl product.

(i) $CH_4 + Cl_2 \xrightarrow[\text{U.V sunlight 500 k}]{h\nu} CH_3 - Cl + HCl.$

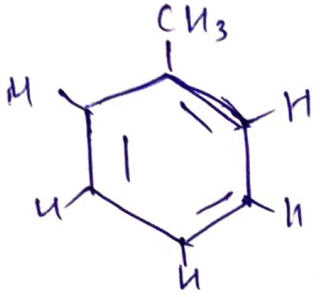
(* Free Radical Mechanism)

$3^\circ > 2^\circ > 1^\circ$

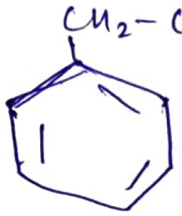
(ii) $CH_3 - CH_2 - CH_3 + Cl_2 \xrightarrow{h\nu}$

$CH_3 - \underset{Cl}{CH} - CH_3$ Major – 2°

$CH_3 - CH_2 - CH_2 - Cl$ Minor – 1°



$+ Cl_2 \xrightarrow{h\nu}$



$+ HCl.$

(3) From Alkenes.

(a) Rxn. with Br_2 in the presence of CCl_4.

$CH_2 = CH_2 + Br_2 \xrightarrow{CCl_4} \underset{Br}{CH_2} - \underset{Br}{CH_2}$

Vicinal dihalide.

$CH_3 - CH = CH_2 + Br_2 \xrightarrow{CCl_4} CH_3 - \underset{Br}{CH} - \underset{Br}{CH_2}$

1,2, Dibromo propane.

(b) Addition of Hydrohalogenation. (H - X)

$CH_2 = CH_2 + H - Br \longrightarrow CH_3 - CH_2 - Br$

$CH_3-CH=CH_2 + H-Br \longrightarrow$ $CH_3-\underset{Br}{CH}-CH_3$ (Major)

$\longrightarrow CH_3-CH_2-CH_2-Br$

MARKONIKOV Rule:

→ If not give mark addition

→ Intermediate = Carboncation.

More H = H

$C=C$

Less H = Br/X

Q.1 $CH_3-\underset{CH_3}{\overset{}{C}}=CH + H-Br \longrightarrow CH_3-\underset{CH_3}{\overset{Br}{C}}-CH_3$ 3° H.A

Q.2 $CH_3-\overset{CH_3}{CH}-CH=CH_2 + H-Br \longrightarrow CH_3-\overset{CH_3}{CH}-\underset{Br}{CH}-CH_3$ 2° H.A.

Q.3 $CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\overset{CH_3}{C}=CH_2 + HBr \longrightarrow CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\underset{Br}{\overset{CH_3}{C}}-CH_3$ 3° H.A.

ANTIMARKONIKOV Rule :-

(Kharash Effect) (Peroxide effect)

H = Less H

Br = More H.

→ Intermediate = Carbon free Radical.

$CH_3-CH=CH_2 + H-Br \longrightarrow$ $CH_3-CH_2-CH_2-Br$ (Major)

1 - Bromo Propane.

$CH_3-\underset{Br}{CH}-CH_3$ ← Peroxide

$CH_3-\overset{CH_3}{\underset{}{C}}-CH-CH_2-CH_3 \xrightarrow{HBr}$ $CH_3-\overset{CH_3}{\underset{CH_3}{C}}-CH_2-CH_2-CH_3$ major.

2 - Bromo 2 - methyl 1 pentane.

Peroxide, HBr ↓

$CH_3-\underset{CH_3}{CH}-\underset{Br}{CH}-CH_2-CH_3$

3-Bromo 2 - methyl pentpane.

(4) From Alkynes

$CH_3 - C \equiv CH + HBr \xrightarrow[\text{Add.}]{\text{Markv}} CH_3 - \underset{Br}{\overset{|}{C}} = CH_2 + H-Br$

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

2,2 - Dibromopropane. gem dihalide.

$CH_3 - C \equiv CH + Br_2 \longrightarrow CH_3 - \underset{Br}{\overset{|}{C}} = \underset{Br}{\overset{|}{CH}} + Br_2$

$CH_3 - \underset{Br}{\overset{Br}{\overset{|}{\underset{|}{C}}}} - \underset{Br}{\overset{Br}{\overset{|}{\underset{|}{CH}}}}$

1,1,2,2 - Tetrabromo propane.

(5) Halogen Exchange Method

(a) Finkelstein Rxn.

$CH_3 - CH_2 - Cl + NaI \longrightarrow CH_3 - CH_2 - I + NaCl.$

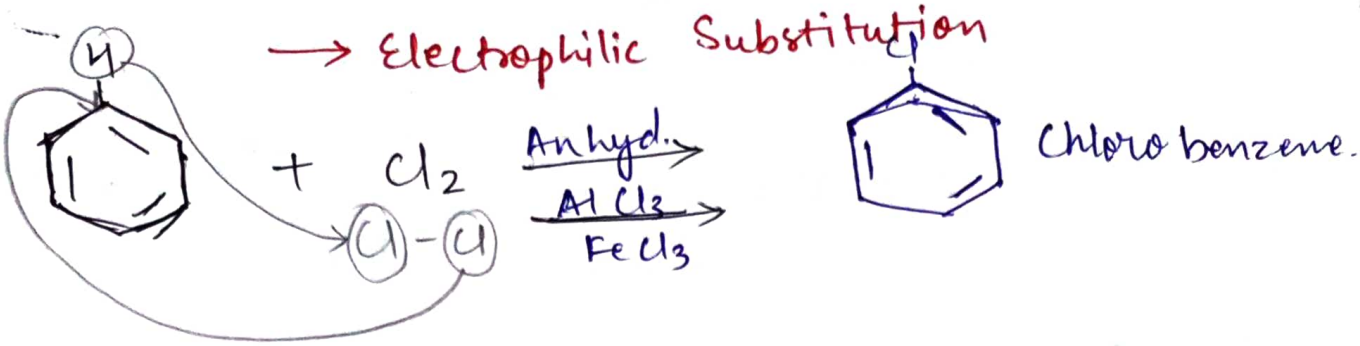
(b) Swarts Rxn. one & only method for making Flouine.

$CH_3 - CH_2 - Cl + AgF \longrightarrow CH_3 - CH_2 - F + AgCl.$

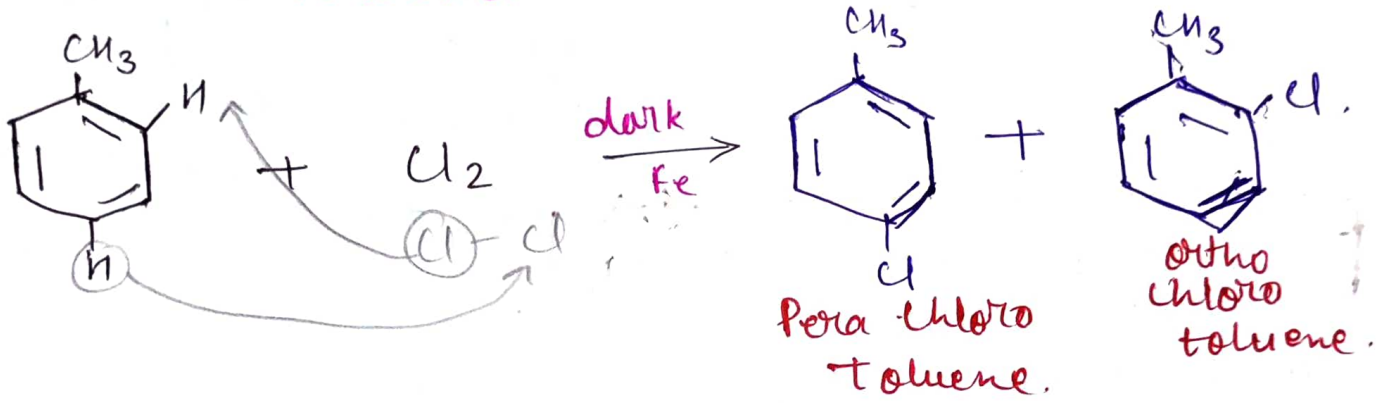
CoF_2
Hg_2F_2
SbF_3

Preparation Of Haloarenes.

(1) From Benzene.

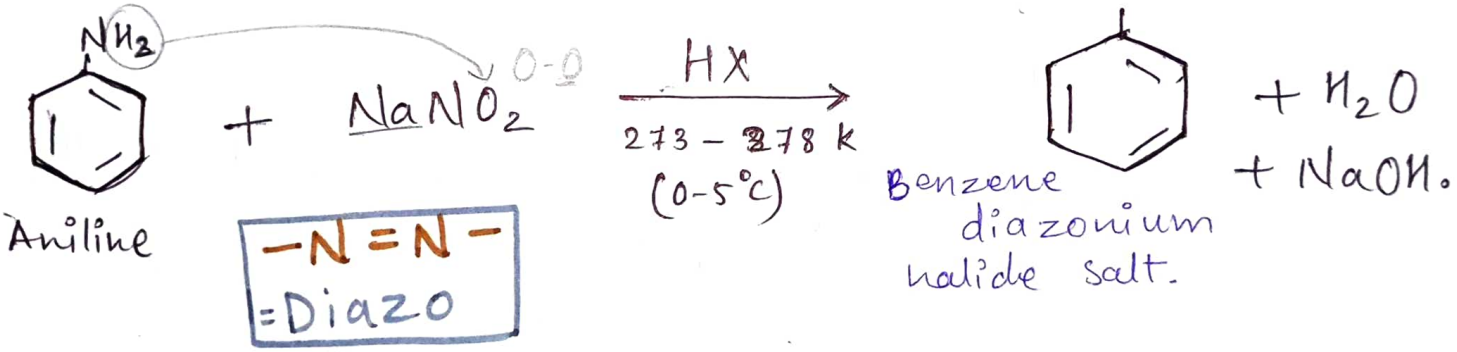


(2) From Toluene.

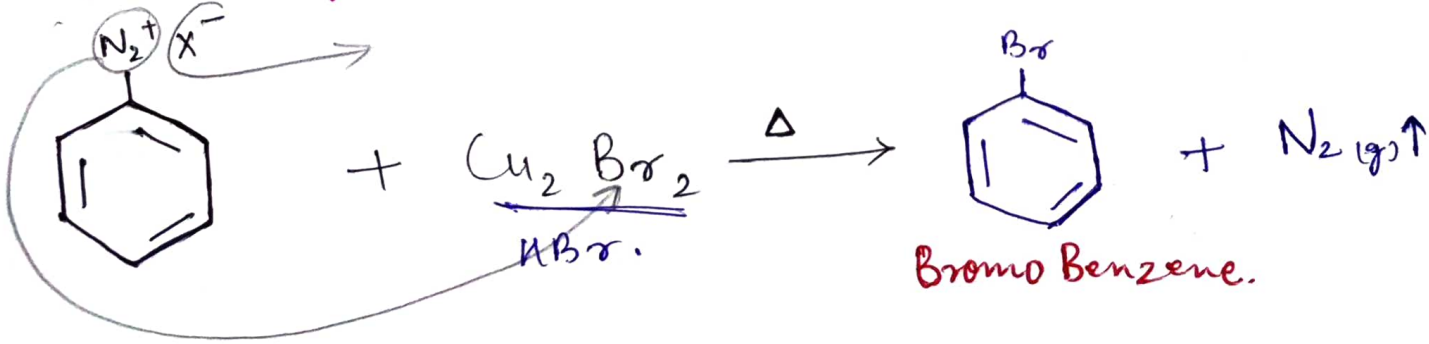


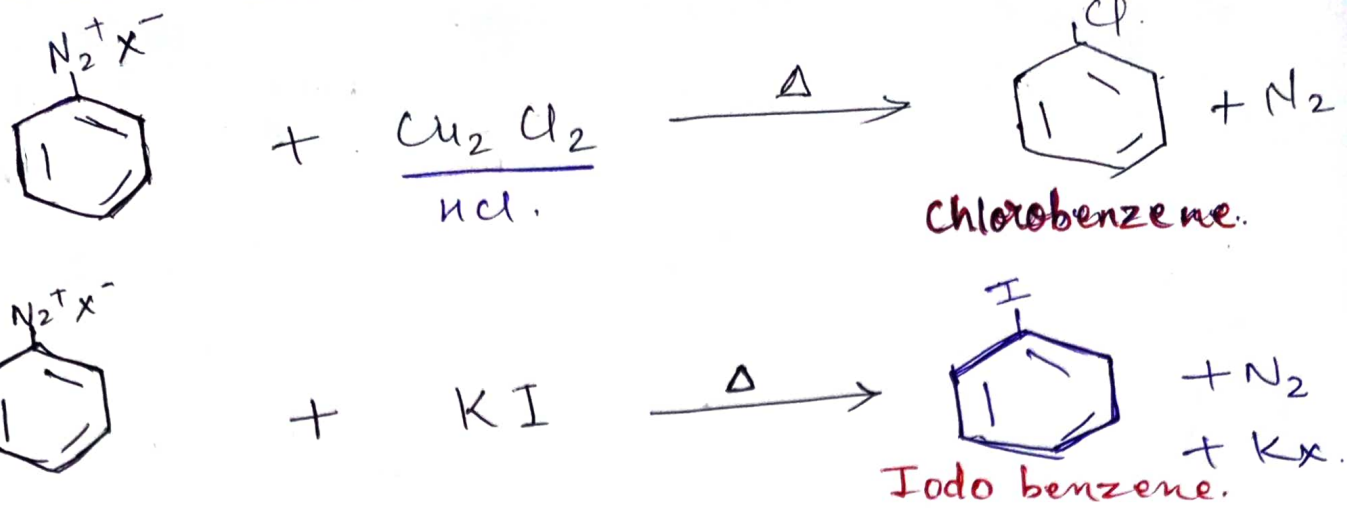
(3) From Aniline

Asset.

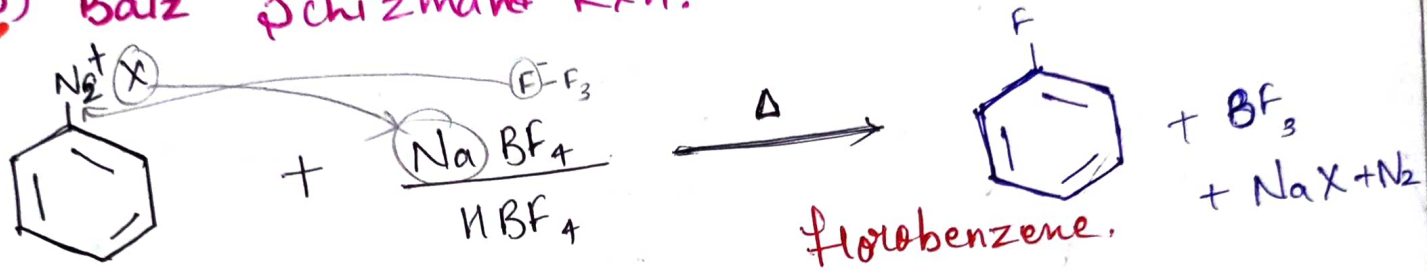


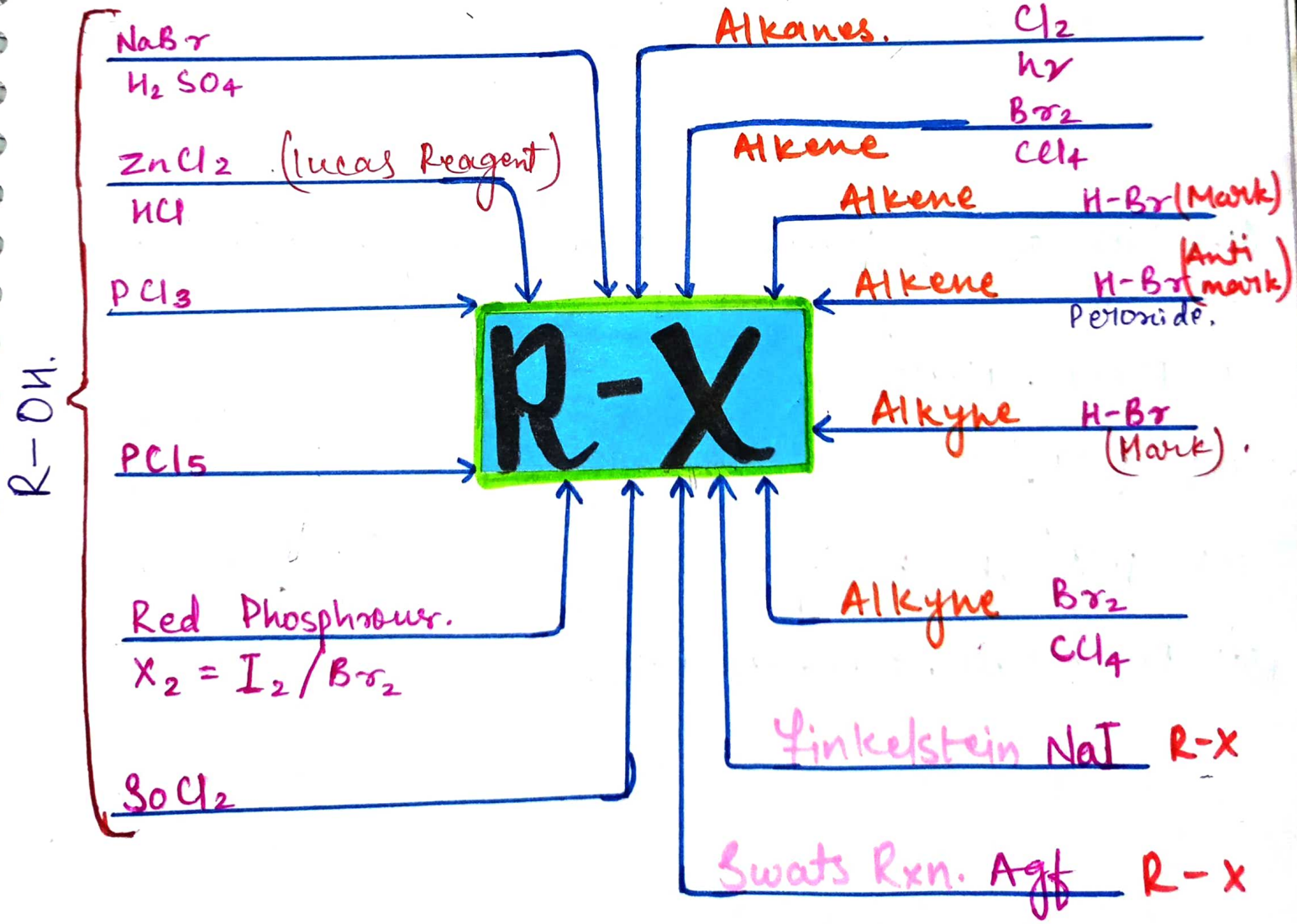
(a) Sand Meyers Reaction

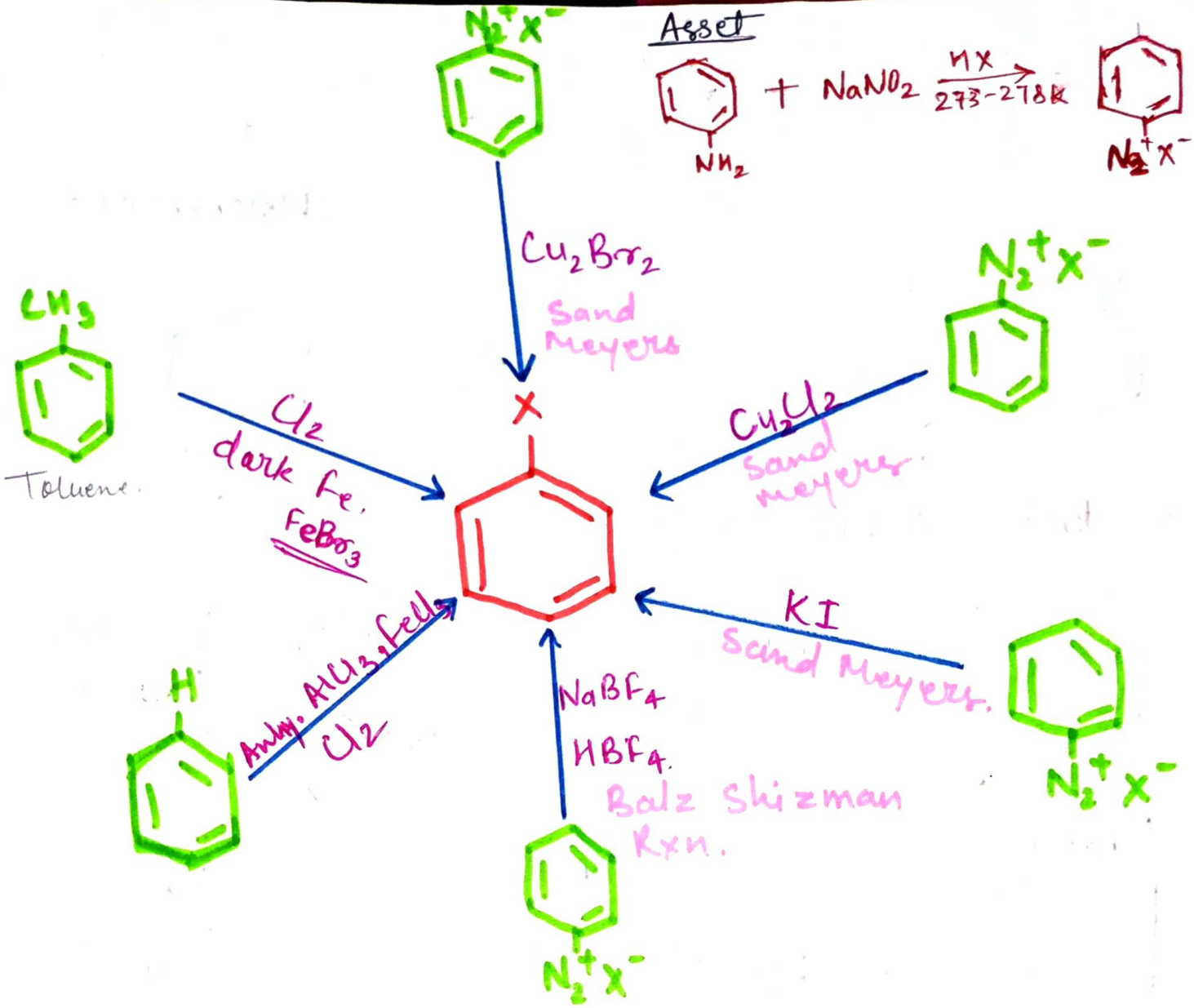




(b) Balz Schizmann Rxn.







Q. Which of the following sequence of reactions is suitable to synthesise chlorobenzene?

(a) Phenol, $NaNO_2$, HCl, CuCl.

(b)  , HCl.

(c)  , HCl, Heating.

(d) Benzene, Cl_2, anhydrous $FeCl_3$.

6, 2 → Ortho.

3, 5 → Meta

4 → Para.

Physical Property

HaloAlkanes

① **State:** $C_1 - C_3$: gas CF_3Cl, $CHCl_2$; CF_3Cl : gas.
$C_3 < C_x$: liq + solid. CH_3-Br(g) exception.

② **Colour:** Colourless but colourful. Bromo & Iodo derivatives (only in the presence of sunlight)

③ **Taste:** Tasteless.

④ **Odour:** Lower R-X have sweet smell & others are odour less.

⑤ **Solubility:** Polar Nature, No. of C ↑ = Solubility ↓
$\propto$ EN $\propto \frac{1}{\text{group of R}}$ $\propto \frac{1}{R(C)}$

⑥ **MP / BP:** MP / B.P $\propto$ Mw
R-I > R-Br > R-Cl > R-F

M.P. / B.P. $\propto \frac{1}{\text{Branching}}$.

⑦ **Density:** Density $\propto$ Mw lighter than water.

$CH_3\frac{F}{9} < CH_3\frac{Cl}{35.5} < CH_3\frac{Br}{80.5} < CH_3\frac{I}{127}$

HALOARENES

(1) State : Liquid. (2) Colour : Colourless.

(3) Taste : Tasteless (4) Odour : odourless.

(5) Solubility : Slightly Soluble. $\frac{\text{Insoluble}}{\text{Due to Benzene Ring.}}$

(6) Density : Density $\propto$ Mw higher than water

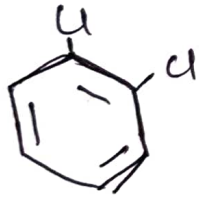
Ar-I > Ar-Br > Ar-Cl > Ar-F

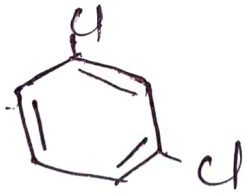
(7) Melting Point / Boiling Point (Di halo derivative)

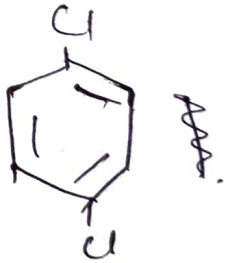
Approximately Same (Boiling Point)

R-I ≈ R-Br ≈ R-Cl ≈ R-F

But in Melting Point.







Ortho << Meta << Para.

↳ Difference in MP in Para group is due to Symmetry of para groups.

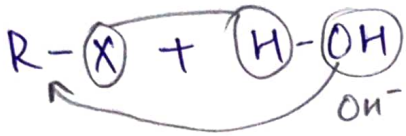
Para > ortho > Meta.

Chemical Property

HALOALKANES.

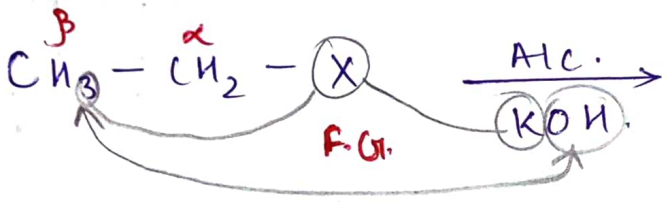
① Nucleophilic Substitution Rxn.

25★



$\longrightarrow$ R-OH + HX $\longrightarrow$ S_N1, S_N2.

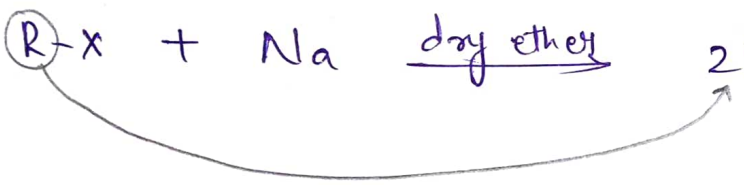
② Elimination Rxn (α, β) (Saitzer Rule)



$CH_2 = CH_2$

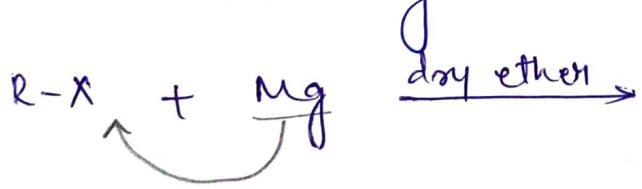
③ Rxn with Metal.

(a) Rxn with Na.



higher alkane. (Wurtz Rxn)

(b) Rxn with Mg.

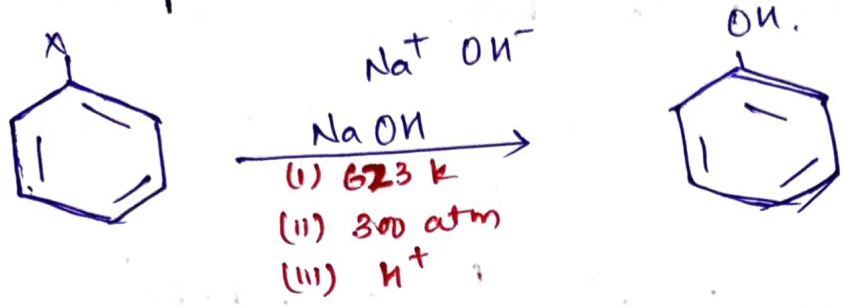


Grignard Rxn. reagent.

HALOARENES.

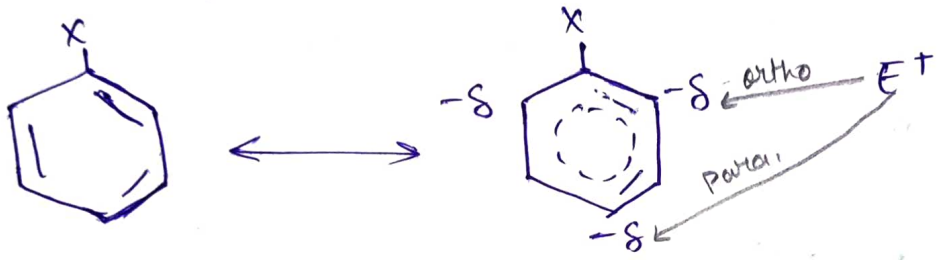
Attacking agent is always electrophilic when it reacts on benzene.

① Nucleophilic Substitution Rxn.



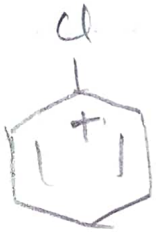
② Electrophilic Substitution Rxn. → 2 product ortho / para.

→ ortho / para directing group.



(a) Halogenation. / Chlorination.

$$+ Cl_2 \xrightarrow[AlCl_3.]{\text{Anhy.}}$$



(b) Nitration.

$$+ HNO_3 \xrightarrow[H_2SO_4.]{\text{Con.}}$$

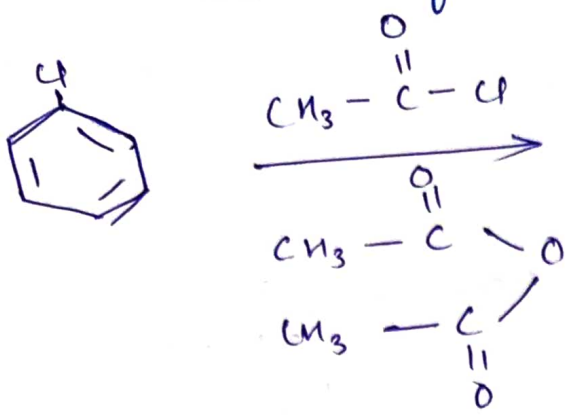
(c) Sulphonation.

$$+ H_2SO_4 \xrightarrow[\text{con.}]{} \longrightarrow$$

(d) Friedel Craft Alkylation Rxn.

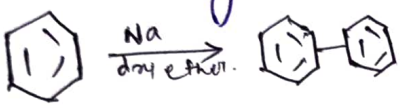
$$CH_3 - Cl + \text{Anhy } AlCl_3$$

(e) Friedel craft Acylation Rxn.



(3) Rxn with Metal.

(a) Fitting Rx n



(b) Wurtz fitting Rxn.

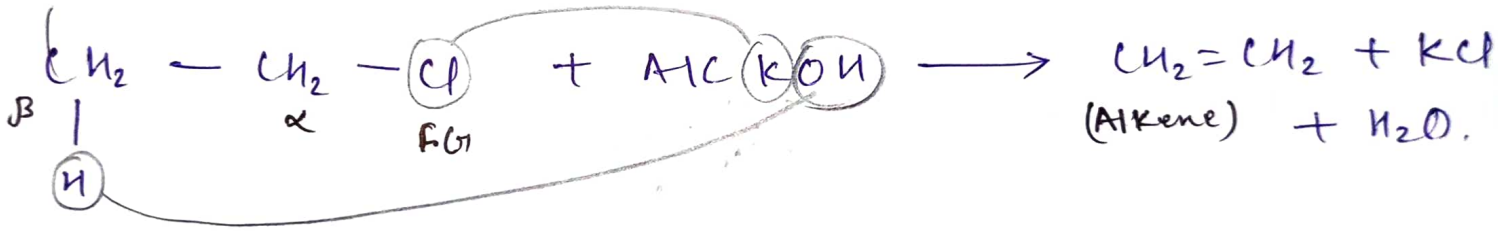
$$R\text{-}X \xrightarrow[\text{dry ether}]{Na} R\text{-}R$$

EXPLANATIONS:

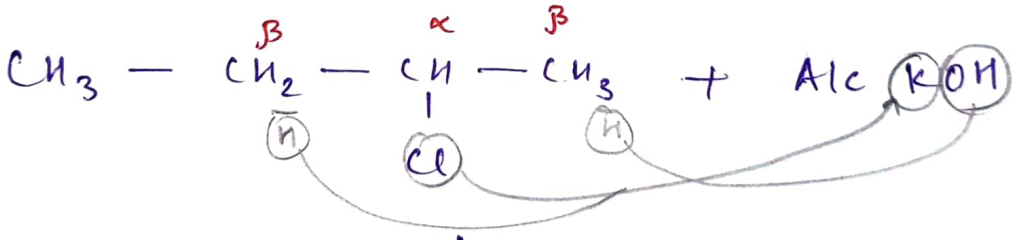
Haloalkanes.

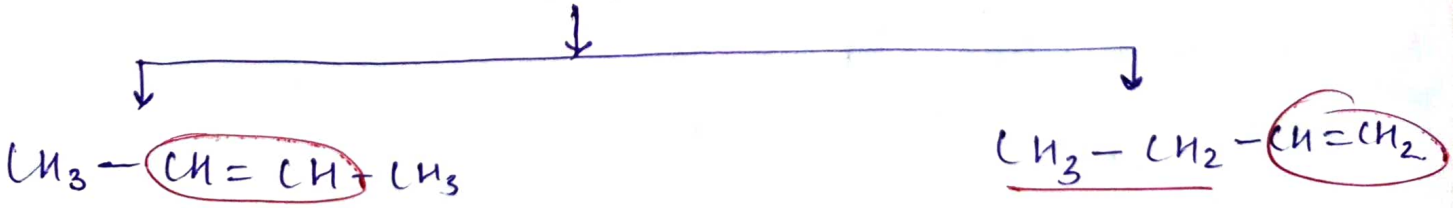
(2) Elimination Rxn. → (1) Dehydro halogenation.

→ (2) α, β elimination Rxn.



Ex:





2 - Butene
Major

1 - Butene.
Minor.

Switzer (Saytzeff) Product.

- More branch of $-\overset{|}{C}=\overset{|}{C}-$ C have more stability.

Q. $CH_3-\underset{\text{B.}}{\overset{CH_3}{\overset{|}{CH}}}-\underset{\alpha}{\overset{|}{CH}}-\underset{\beta}{CH_3}$ (Br)

Alc KOH.

$CH_3-\overset{CH_3}{\overset{|}{C}}=CH-CH_3$ — 3 branch. Major.

$CH_3-\overset{CH_3}{\overset{|}{CH}}-CH=CH_2$ — 1 Branch.

Q.1 $CH_3-\underset{Cl}{\overset{|}{CH}}-\overset{CH_3}{\overset{|}{C}}-CH_3$ (CH₃)

$\longrightarrow CH_3-\overset{CH_3}{\overset{|}{\overset{\alpha}{C}}}-\overset{\beta}{CH}-CH_3$ (Cl, CH₃)

$\longrightarrow CH_3-\overset{CH_3}{\overset{|}{C}}=C-CH_3$ (CH₃)

Q.2 $CH_3-\overset{CH_3}{\overset{|}{C}}(CH_3)-\overset{Cl}{\overset{|}{CH}}-CH(CH_3)-CH_3$

Methyl shifting.

$CH_3-\overset{CH_3}{\overset{|}{C}}(Cl)-CH(CH_3)-CH_3$

$\downarrow$

$CH_3-\overset{CH_3}{\overset{|}{C}}=\overset{CH_3}{\overset{|}{C}}-CH(CH_3)-CH_3$

Q. Elimination Rxn of 2-bromo-pentane to form pent-2-ene is:

$CH_3-\underset{\beta}{CH}(Br)-\underset{\alpha}{CH_2}-CH_2-CH_3$

1. β-elimination rxn.
2. Follows Zaitsev rxn. $CH_3-CH=CH-CH_2-CH_3$.
3. Dehydrohalogenation rxn.
4. Dehydration Rxn.

(a) 1, 3, 4 (c) 1, 2, 4

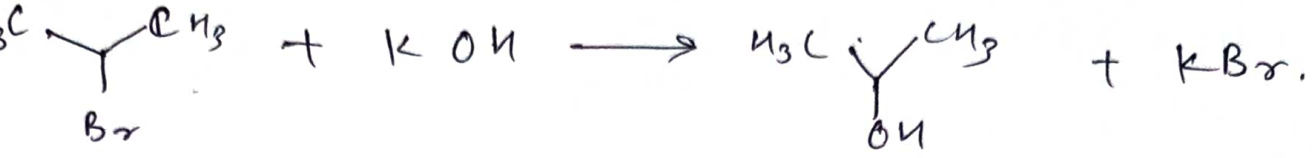
(b) 2, 3, 4 (d) 1, 2, 3

Q. For the following reactions. (NEET 2016).

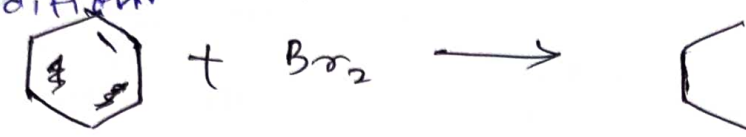
elimination.

(i) $CH_3CH_2CH_2Br + KOH \longrightarrow CH_3CH=CH_2 + KBr + H_2O$.

Substitution.

(ii) 

Addition.

(iii) 

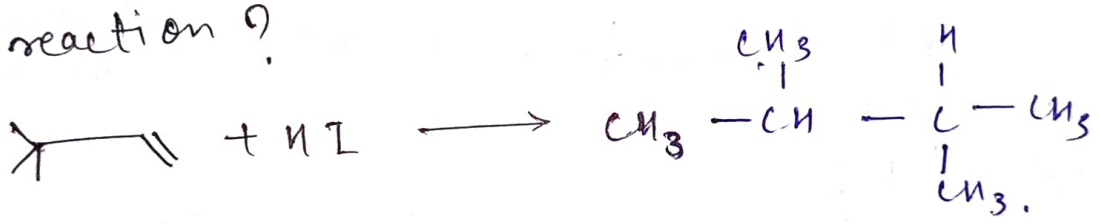
~~(a)~~ (i) is elimination rxn (ii) is substitution (iii) Addition Rxn.

(b) (i) elimination rxn (ii) and (iii) are substitution.

(c) (i) substitution, (ii) and (iii) are addition rxn.

(d) (i) and (ii) are elimination. rxn. and (iii) is addition rxn.

Q. What is the major product of following reaction?



(a) 

(b) 

~~(b)~~ 

What is proton / Me^- shifting.

→ Saitzen Rule → More branch.

→ Mark addition →

③ Rxn with metal.

(a) Wurtz Rxn. $2C \rightarrow 4C$, $3C \rightarrow 6C$] Even carbon.

1) $CH_3 - Cl + Na \xrightarrow[\text{ether}]{\text{dry}} CH_3 - CH_3 + NaCl$.

2) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - Cl + Na \xrightarrow[\text{ether}]{\text{dry}} CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3 + NaCl$.

3) $CH_3 - Cl$ + $CH_3 - CH_2 - Cl$ $+ Na \xrightarrow[\text{ether.}]{\text{dry.}}$ $CH_3 - CH_3$ + $CH_3 - CH_2 - CH_2 - CH_3$ + $CH_3 - CH_2 - CH_3$

* Bcz they all have same B.P $C_1 - C_5$ = gas

It is not possible to differ that hydrocarbon by simple distilation method.

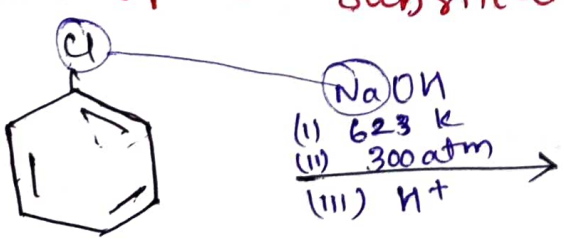
(b) Rxn with Mg.

$CH_3 - Cl + Mg \xrightarrow[\text{ether}]{\text{dry}} \overset{-\delta}{CH_3} - \overset{+\delta}{Mg} - \overset{-\delta}{Cl}$

Grignard Reagent.

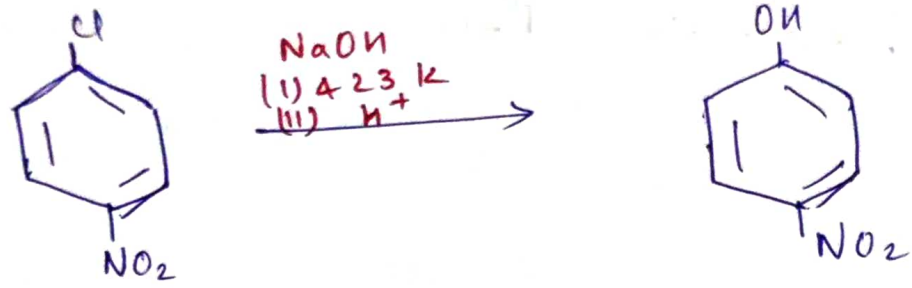
Haloarenes.

① Nucleophilic Substitution Rxn.



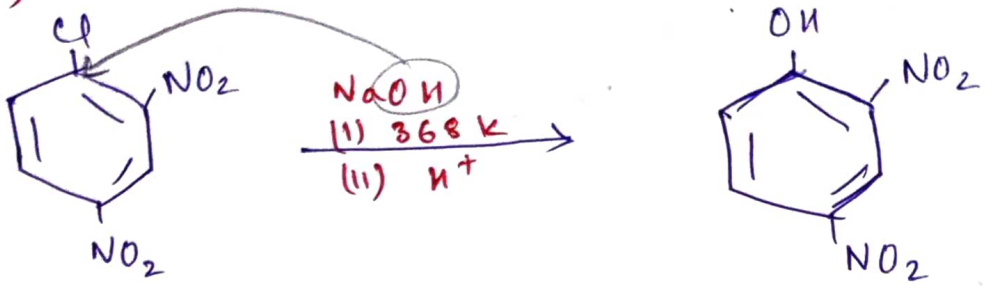
phenol.

(II)



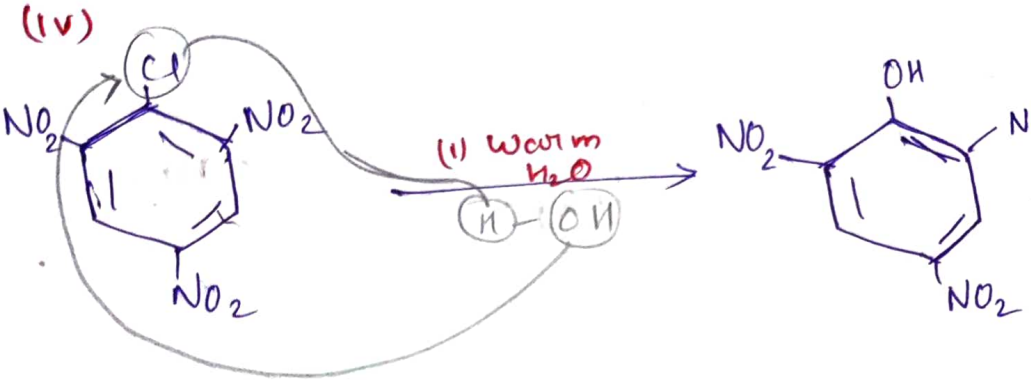
4 - Nitrophenol.

(III)



2, 4, Dinitrophenol.

(IV)



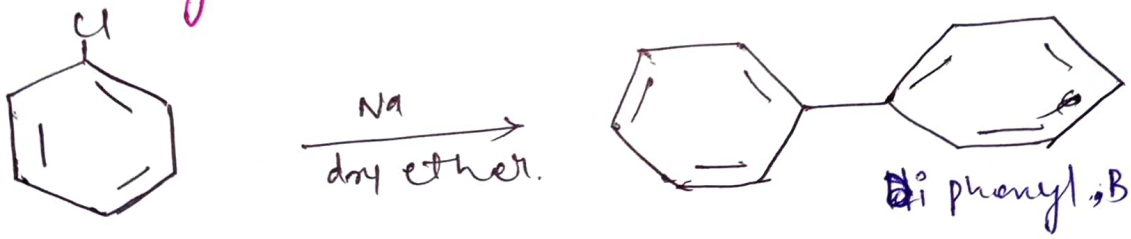
2, 4, 6 - Trinitrophenol

Picric Acid.

* Most Acidic substance in organic world.

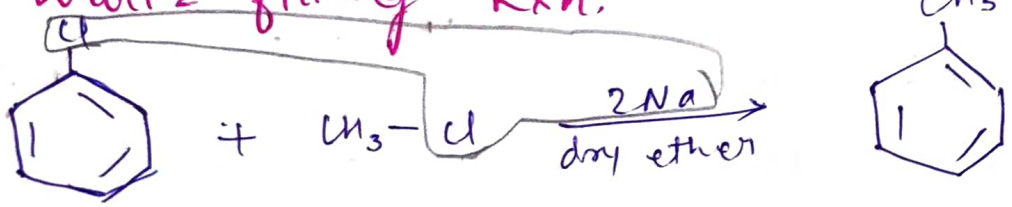
(2) Rxn with Metal.

(a) Fitting Reaction.

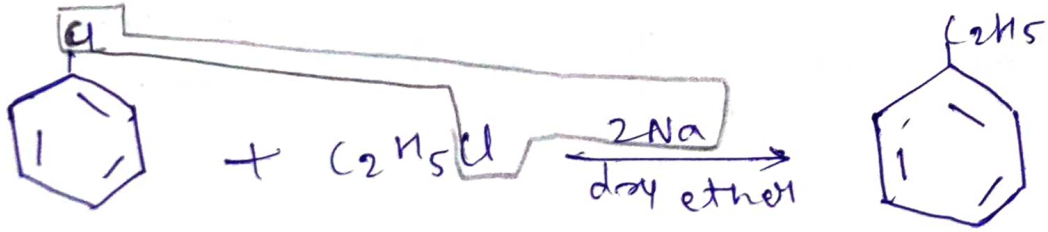


Di phenyl, Biphenyl.

(b) Wurtz fitting Rxn.

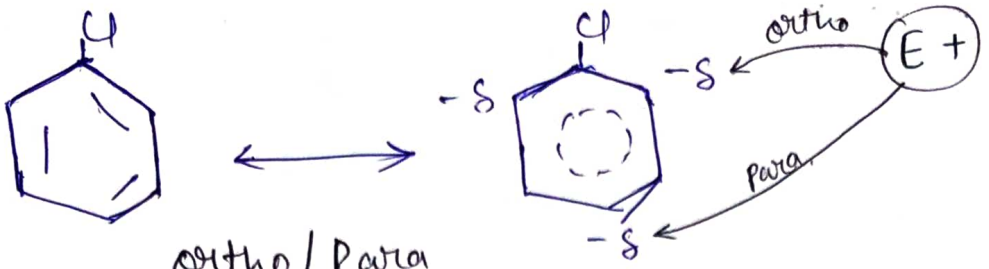


Toluene.



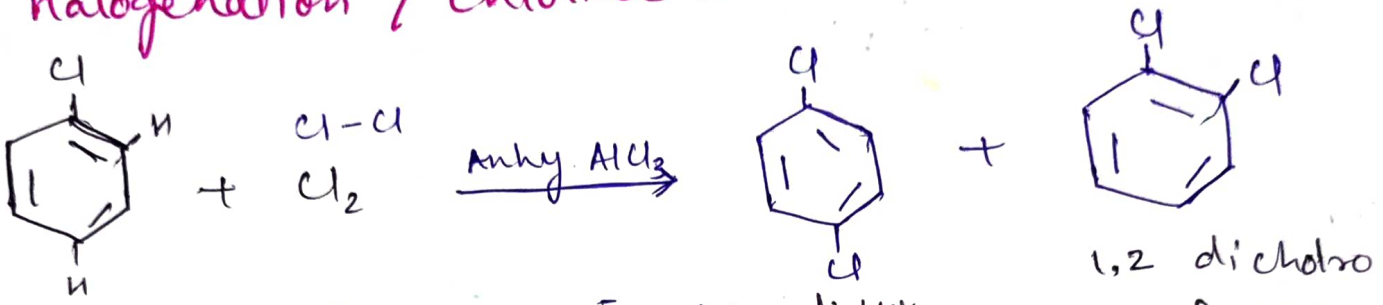
ethyl benzene.

(3) Electrophilic Substitution Rxn.



ortho / Para directing group.

(a) Halogenation / Chlorination.



$AlCl_3 + Cl_2 \rightarrow (AlCl_4)^- + Cl^+$

1,4 dichloro benzene. (major)

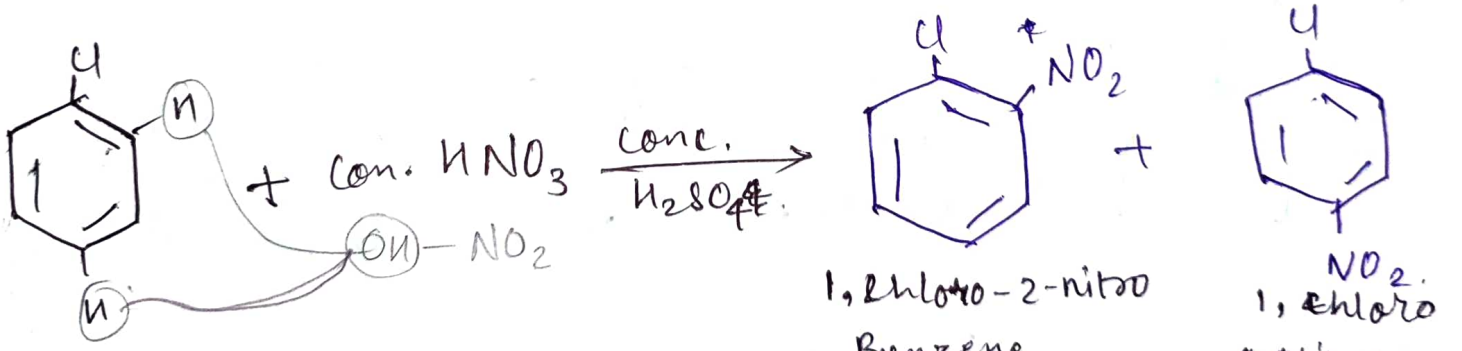
1,2 dichloro Benze. (Major)

↳ Electrophile Cl^+

↳ Major. Para

↳ Intermediate chloroarenium Ion.

(b) Nitration.



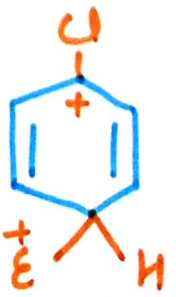
1, Chloro-2-nitro Benzene (Minor).

1, chloro 4 Nitro Benzene. (Major)

↳ Electrophile NO_2^+

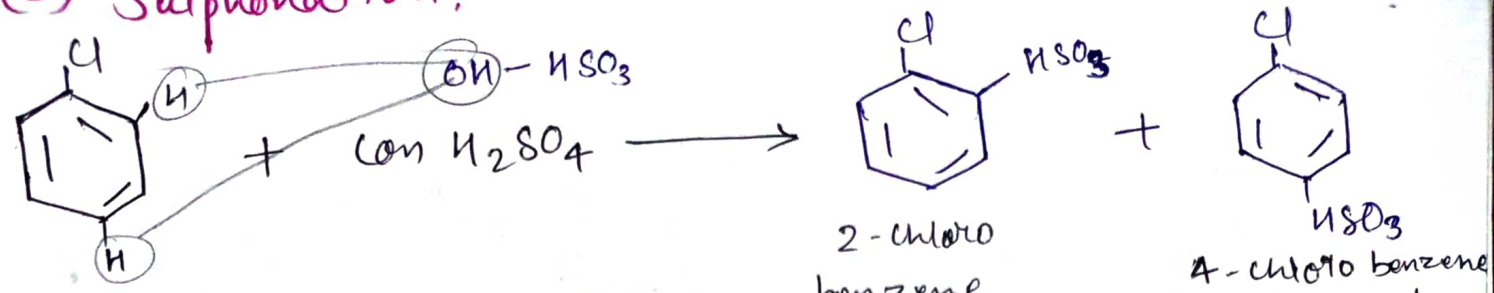
↳ Major Para

↳ Intermediate chloro Arenium Ion.



Chloro Arenium Ion.

(c) Sulphonation.



2-chloro benzene sulphonic acid.

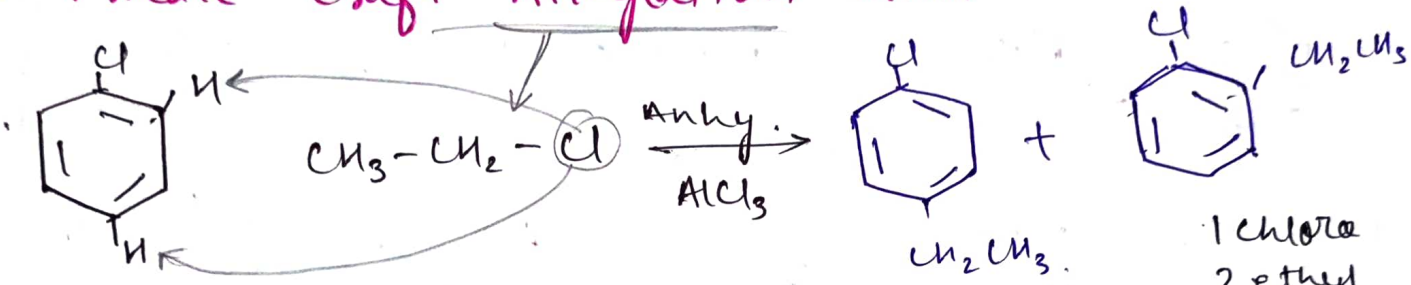
4-chloro benzene sulphonic acid. (Major).

→ Electrophilic HSO_3^+.

→ Major Para.

→ Intermediate (Halo Arenium Ion.

(d) Friedle Craft Alkylation Rxn.



1 chloro 4 ethyl benze (Major)

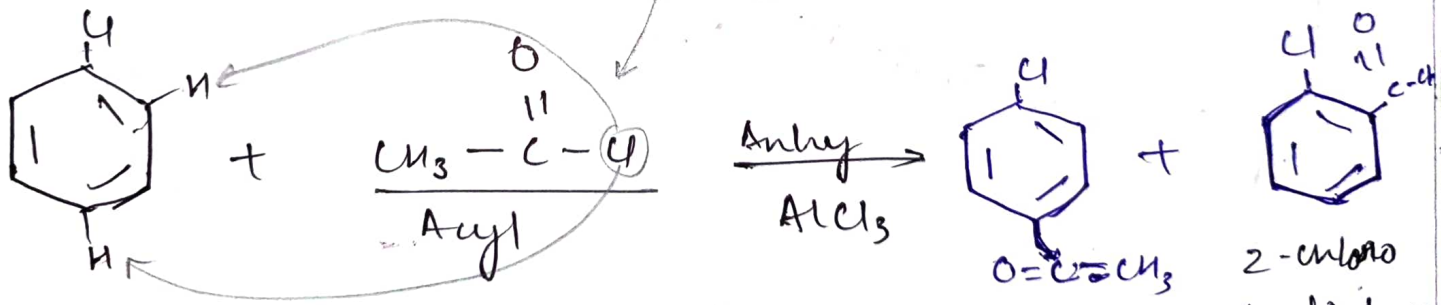
1 chloro 2 ethyl benzene. Minor.

→ Electrophile $CH_2-CH_3^+$

→ Intermediate chloro Arenium Ion.

→ Major Para.

(e) Friedel Craft Acylation Rxn.



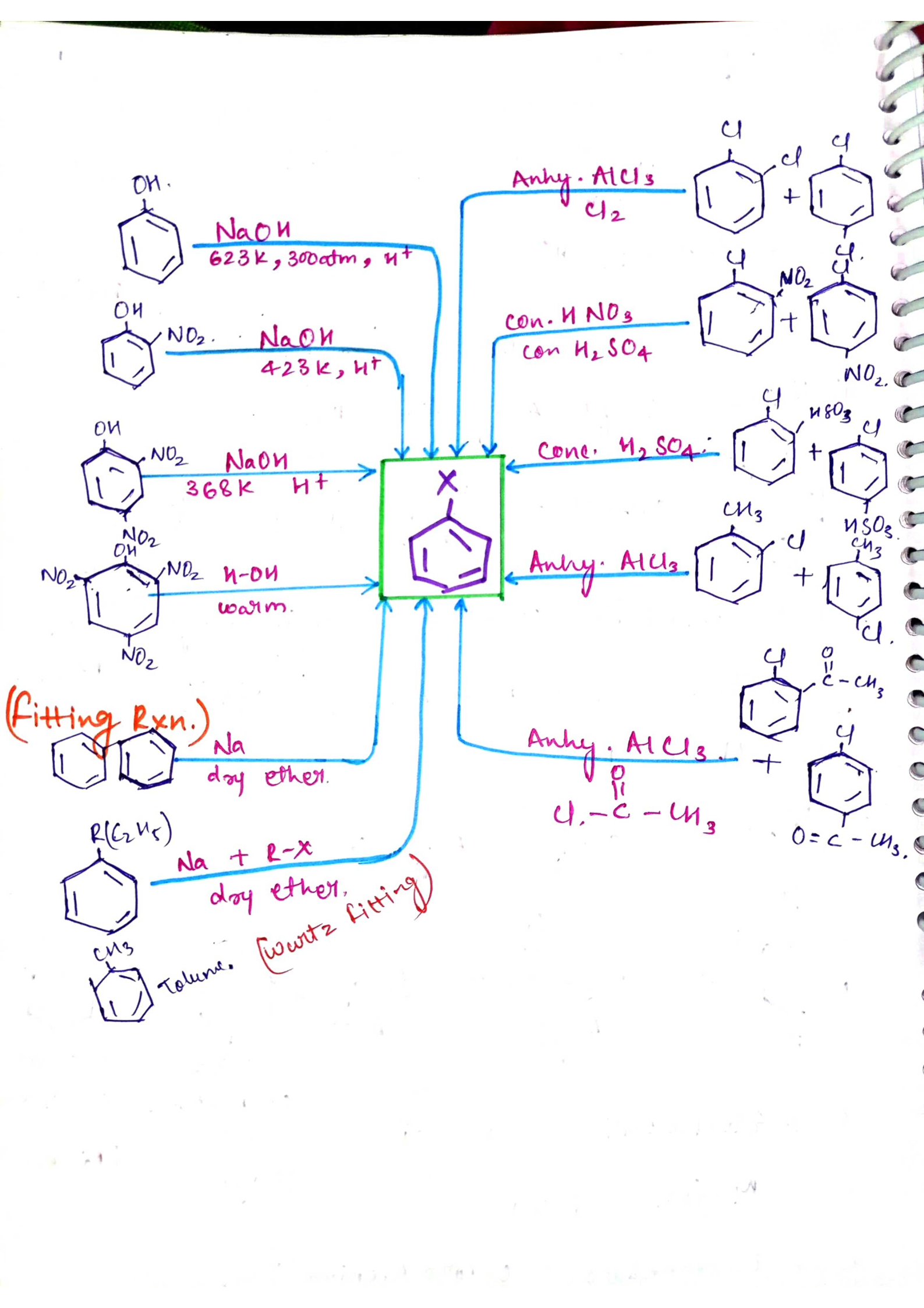
4 chloro Aceto-Phenone (Major)

2-chloro Acetophenon (Minor)

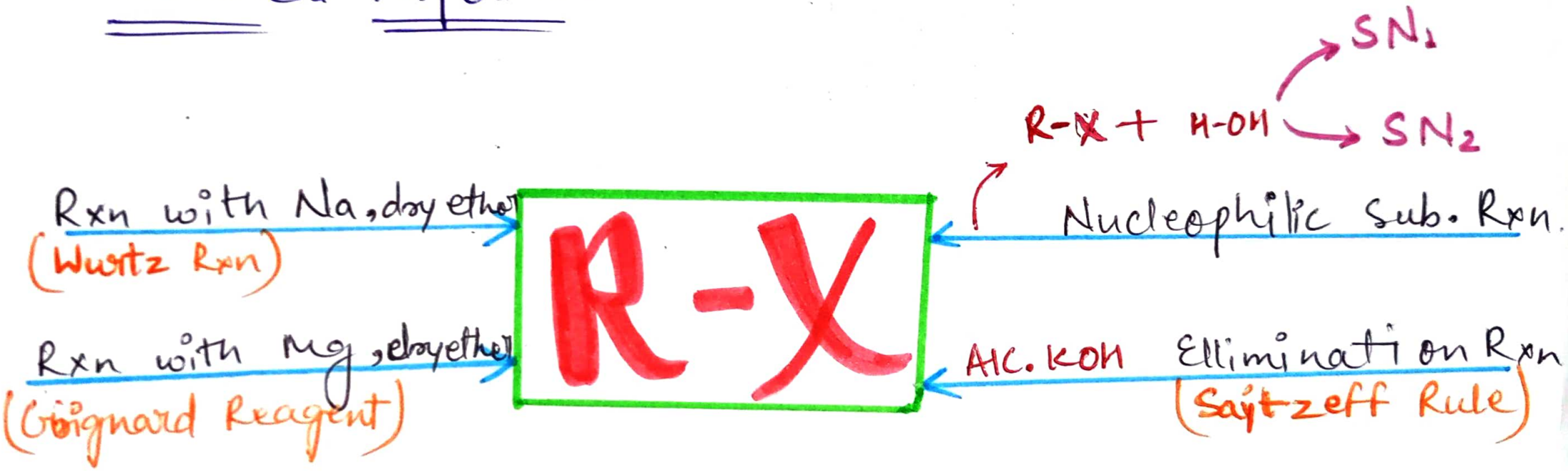
→ Electrophilie = $CH_3-\overset{O}{\overset{\|}{C}}^+$

→ Major. = Para

→ Intermediate = chloro Arenium Ion.


X
NaOH
623K, 300atm, H+
NaOH
423K, H+
NaOH
368K H+
H-OH
warm.
Na
dry ether.
Na + R-X
dry ether.
(Wurtz Fitting)
Toluene.
(Fitting Rxn.)
Anhy. AlCl3
Cl2
con. HNO3
con H2SO4
Conc. H2SO4
Anhy. AlCl3
Anhy. AlCl3

* Chemical Properties



Q. Physical properties in ↓C order of boiling point.

1] Bromomethane, Bromoform, Chloromethane, Dibromomethane.
CH_3-Br $CHBr_3$ CH_3Cl CH_2Br_2.

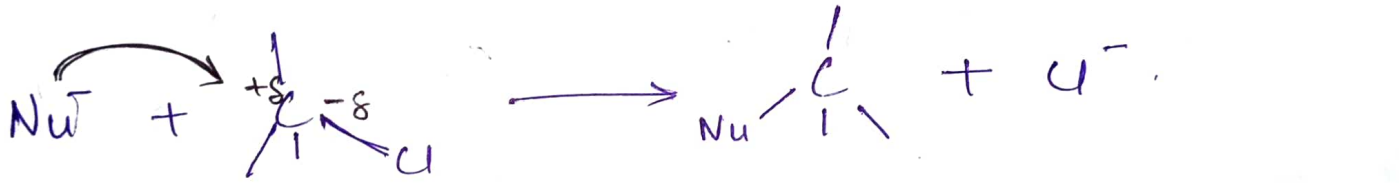
Ans. $CH_3Cl < CH_3Br < CH_2Br_2 < CHBr_3$.

2] 1-chloropropane, Isopropyl chloride, 1-chlorobutane.
$CH_3-CH_2-CH_2-Cl$, $CH_3-\underset{\underset{CH_3}{|}}{CH}-Cl$ $CH_3-CH_2-CH_2-CH_2-Cl$.

Ans. $CH_3-CH_2-CH_2-CH_2-Cl > CH_3-CH_2-CH_2-Cl > CH_3-\underset{\underset{CH_3}{|}}{CH}-Cl$

Haloalkanes.

① Nucleophilic substitution Rxn.



Eg:

1] $CH_3-Cl + NaOH \longrightarrow CH_3OH + NaCl$
Alc.
OH^-

2] $CH_3-Cl + KOH \longrightarrow CH_3-OH + KCl$.
Alc

3] $CH_3-Cl + H_2O \xrightarrow{H-OH^-} CH_3-OH + HCl$.
Alc.

4] $CH_3-Cl + NH_3 \longrightarrow CH_3-NH_2 + HCl$.
$H^+-NH_2^-$
1° Amine.

5] $CH_3-Cl + Na^+ O^- CH_3 \longrightarrow CH_3-O-CH_3 + NaCl$
ether.

6] $CH_3-Cl + NH_2-CH_3 \longrightarrow CH_3-NH-CH_3 + HCl$
$H^+ - CH_3NH^-$
2° Amine.

7] $CH_3-Cl + NaI \longrightarrow CH_3-I + NaCl$
(I^-)
Haloalkane.

8] $CH_3-Cl + CH_3-NH-CH_3 \longrightarrow CH_3-N(CH_3)-CH_3 + HCl$
$H^+ - N(CH_3)_2$
3° Amine.

* Ambidentate Nucleophiles.

25

→ Nucleophile which contain more than two types of species which can give or attack as nucleophile.

Ex: CN^-

- $C^- \equiv N$ cynide (Nitrile)
- $\bar{N} \equiv C$ Iso cynide (Iso Nitrile)

NO_2^-

- $O^- - N = O$
- $-N(=O)-O$

5

9] $CH_3-Cl + KCN \longrightarrow CH_3CN + KCl$
cynide.

5

10] $CH_3-Cl + AgCN \longrightarrow CH_3NC + AgCl$

V.IP

11] $CH_3-Cl + KNO_2 \longrightarrow CH_3-ONO + KCl$.

V.IP

12] $CH_3-Cl + AgNO_2 \longrightarrow CH_3-NO_2 + AgCl$.

13] $CH_3-Cl + CH_3-COO-Ag \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-O-CH_3 + AgCl$.

(CH_3COO^-) — ester.

14] $CH_3-Cl + LiAlH_4 \longrightarrow CH_4 + LiAlCl$.

(H^-)

15] $CH_3-Cl + Na \xrightarrow{\text{dry ether}} CH_3-CH_3$

higher alkane.

16] $CH_3-Cl + Mg \xrightarrow{\text{dry ether}} CH_3-Mg-Cl \xrightarrow{H-OH} CH_4$.

Mechanism of Nucleophilic Sub. Rxn.

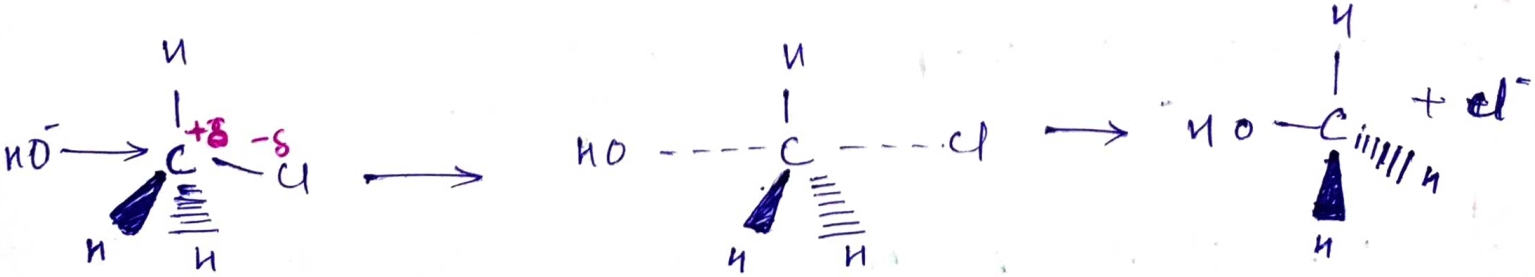
1. S.N2 Reaction → when Non-polar solvent are present ∴ Ex CS_2, Benzene.

$CH_3-Cl + OH^- \longrightarrow CH_3-OH + Cl^-$

($-(R-X)$)

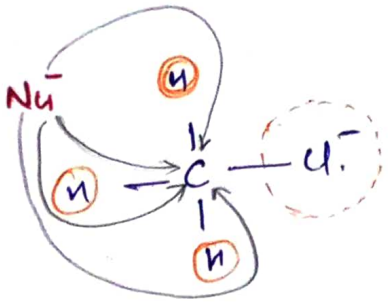
Rate of rxn = $r = k[R-X]^1[Nu]^1$

Order = 2



Transition State.

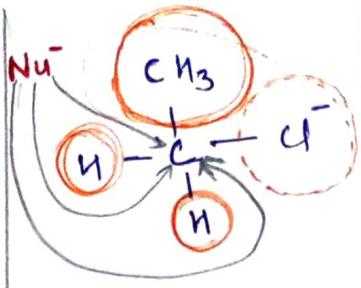
Reactivity Order.



Rate - 10^{40}

CH_3-Cl.

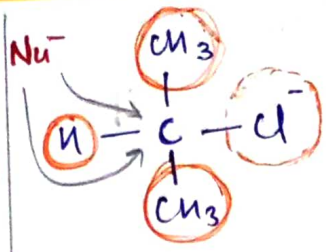
Methyl Chloride.



Rate - 10^{30}

CH_3-CH_2-Cl

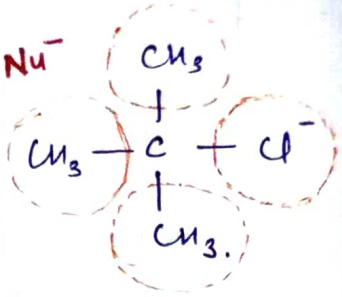
1° Haloalkane. Alkyl halide.



Rate - 10^{20}.

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

2° Haloalkane. Alkyl halide



Rate - 10

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

3° Haloalkanes. Alkyl halide.

Reactivity Order:

Methyl Halide > 1° > 2° > 3°

Reactivity order is defined by Steric Effect

Bade group ke karan attack nd karne ki Shithi.

> SN-2

① Rate $r = k[R-X][Nu^-]$.

② Reactivity order.

Methyl H.A > 1° > 2° > 3°.

③ Steps - Single steps.

④ Invertion of configration.

⑤ Intermediate - No. (Transtion state)

⑥ Reactivity order defined by: Steric effects.

⑦ Order - 2.

⑧ Non polar solvent, CS_2, Benzene } 100% SN-2

2. S.N-1 Reaction.

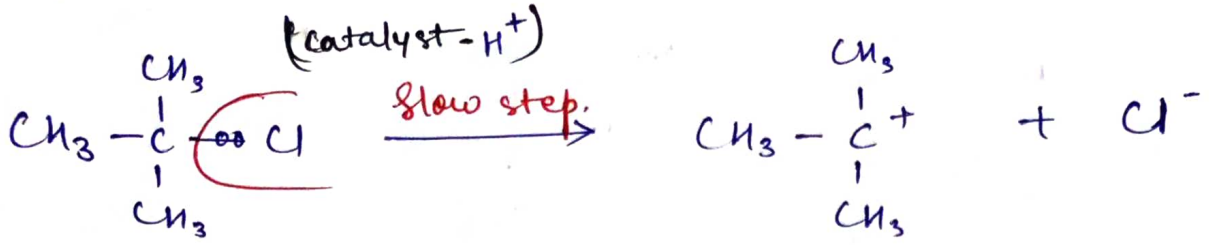
→ Protic / Polar Solvent (H^+)

H_2O, R-OH, Acid etc.

→ Steps - two.

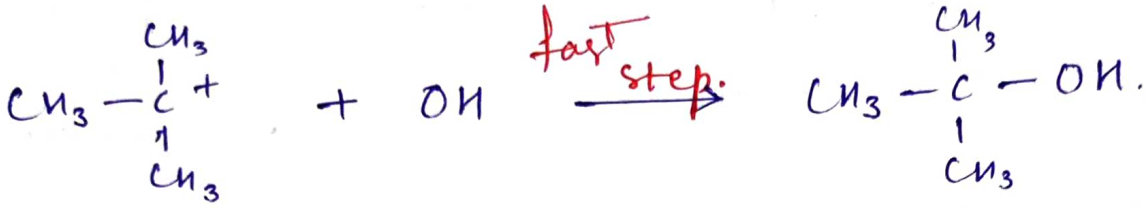
→ Order - 1

Step. I.



$R \cdot r = k[R-X]$

Step. II



→ Intermediate - carbocation.

→ Reactivity Order - $3^\circ > 2^\circ > 1^\circ >$ Methyl H.A.

→ ~~Order~~ - ~~1~~. Due to stability of carbocation.

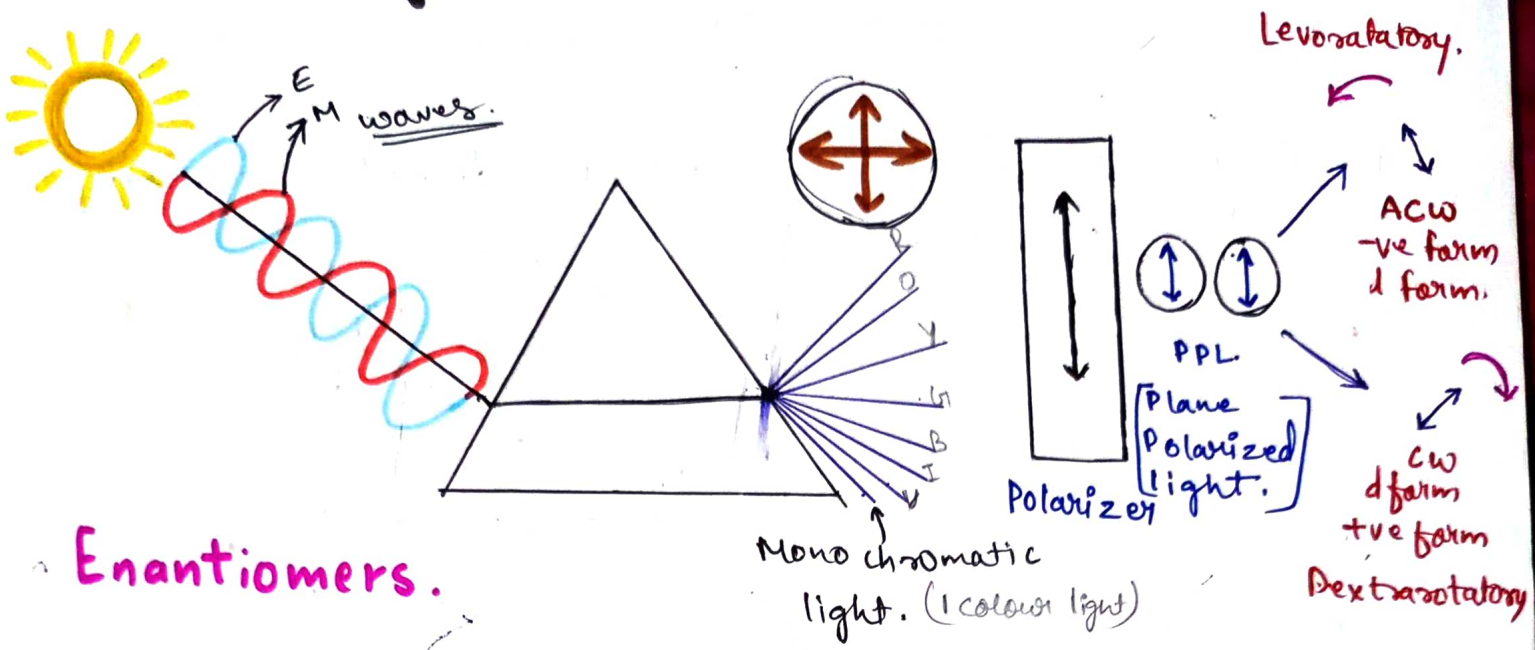
SN - 2

- Non polar / Non protic
- rate $r = k[R-X][Nu^-]$.
- step = One.
- Order = 2
- Intermediate - Transition state.
- Reactivity Order.
  Methyl H.A > 1° > 2° > 3°
- Due to steric effect.
- Inversion of configration. (Product)

SN - 1.

- protic / polar (H^+, OH^-)
- rate = $r\ k[R-X]$.
- Step = two.
- Order = 1.
- Intermediate - carbo cation.
- Reactivity Order.
  $3^\circ > 2^\circ > 1^\circ >$ Methyl. H.A.
- stability of carbo cation.
- Optical Isomer.
- Product = Racemic Mixture.

Optical Isomers.



Enantiomers.

Enantiomers: A compound which can rotate PPL in C.W or A.C.W directions that is called enantiomers. and the compounds are called optically active.

Levorotatory: -ve form / l form.

→ which can rotate light in A.C.W direction.

Dextrorotory: +ve form / d form.

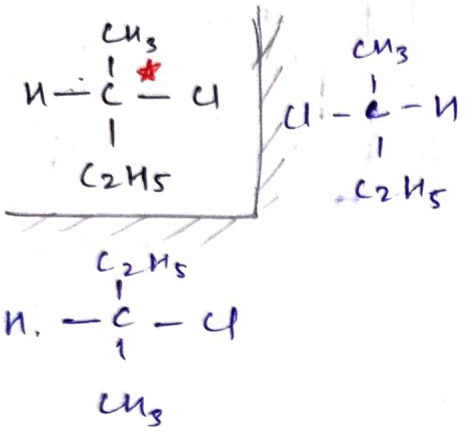
→ which can rotate light in C.W direction.

Racemic Mixture: 50% CW / 50% ACW rotate. that is called racemic mixture and the process are called racemisation

* Rotation are zero still optically active.

Meso compounds: A compounds which is optically inactive.

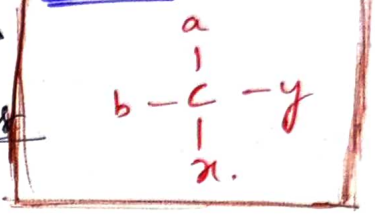
Chirality: A compounds which do not superimpose there mirror image.



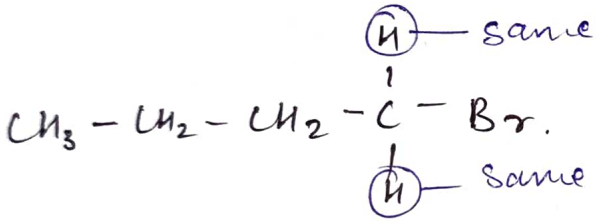
Trick

Chiral

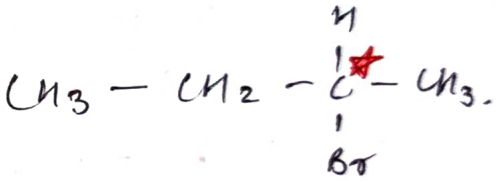
It's a Conditions



Q.

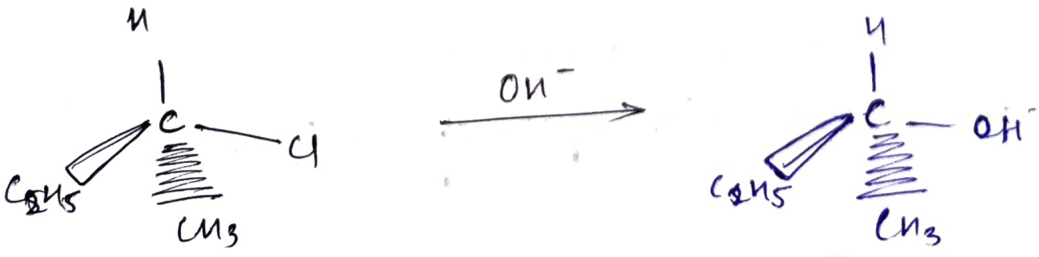


Non-chiral.



Chiral.

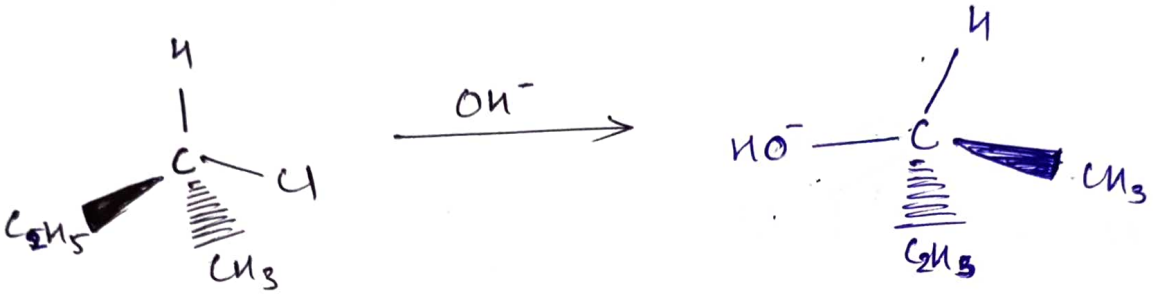
1. Retention: When configration are completely same and only position of ~~electro~~ nucleophile are change that is called Retention (their is no change in configrautation)



d form

d form.

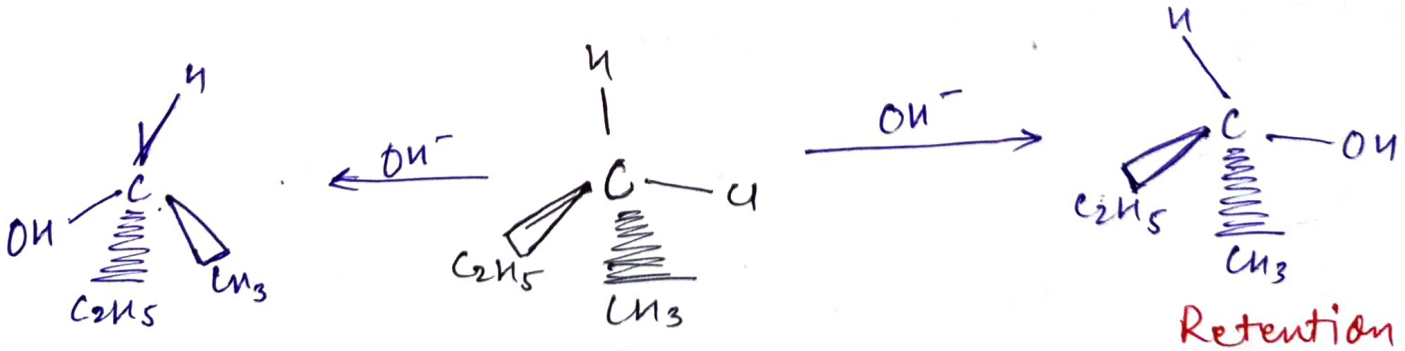
2. Invertion: When configratation are completelly change from its initial and the place of nucleophile are completely different from its original place. that is called Invertion. In that case if initially the compound are in d-form it is converted into the l- form.



l form

d form.

3. Racemic Mix: When the configration are 50%. retention and 50% Indertion that condition are called Racemic mixture. and the process are called Racemisatation.



Invertion.
(A)

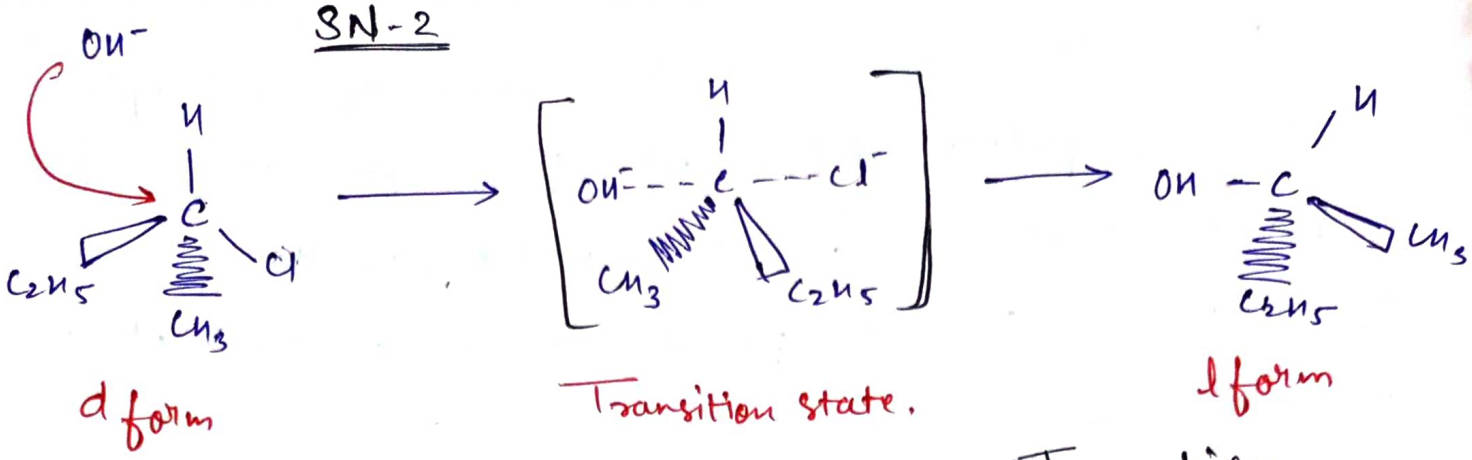
A + B
50% + 50%

Racemic mixture.

Retention
B.

Let us Talk About SN-2 & SN-1.

SN-2



d form

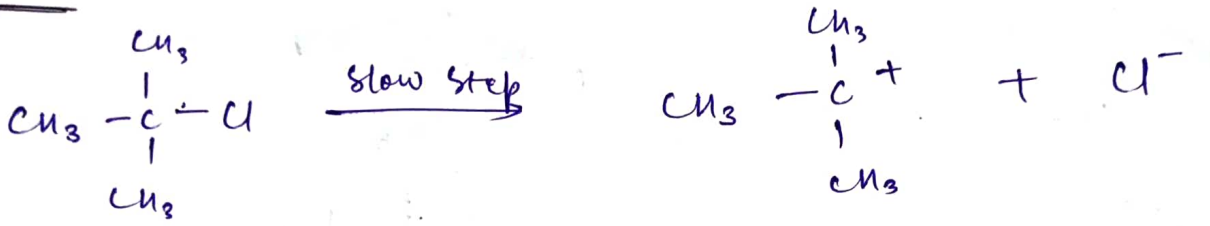
Transition state.

l form

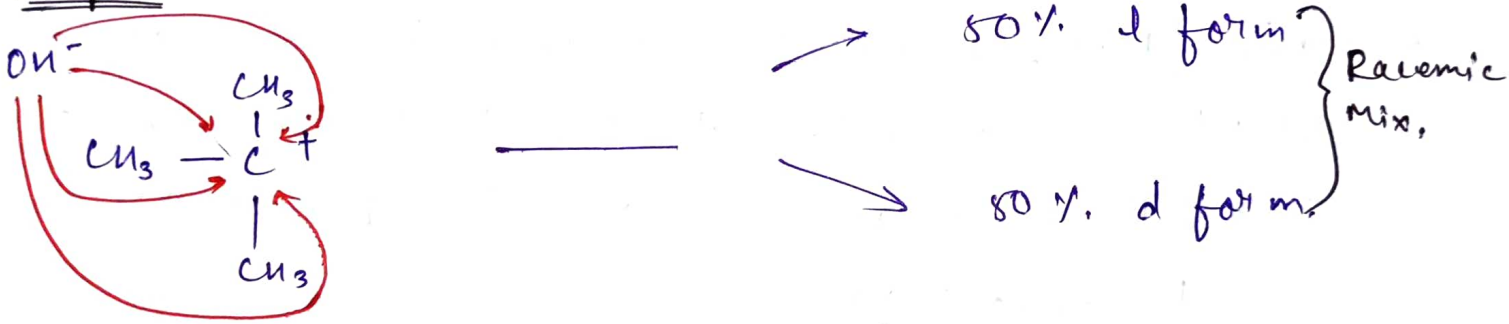
Invertion.

SN-1

Step-1

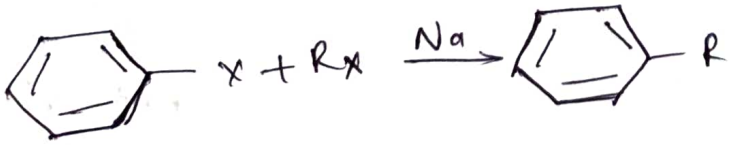


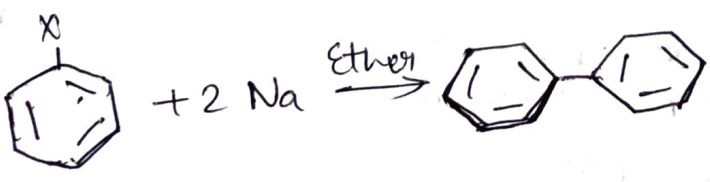
Step-2



Poly Halogen Compounds. NCERT.

Q.44. Match the reaction given in column I with the name.

A. 

B. 

1. Fitting Reaction.

2. Wurtz fitting Reaction.