

Short Answer Collection

Year (2026-27)



Dr Brajesh yadav



Chemistry Department



**Brahmavart p g college
mandhana kanpur (UP)**



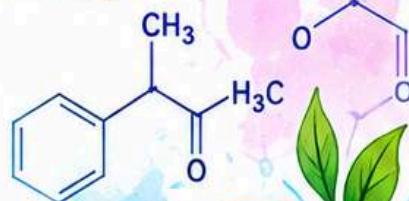
B.Sc Fifth Semester



Organic Synthesis A
Paper Code : B020501T



**Coll.: Brahmavart p g college
mandhana kanpur**



Q.1

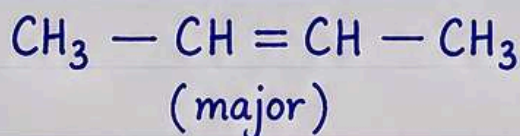
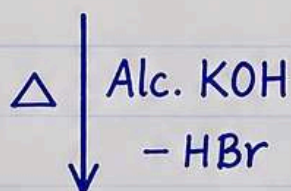
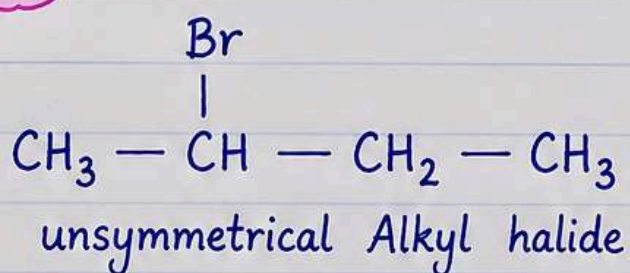
Saytzeff rule for preparation of Alkene.

According to this rule :-

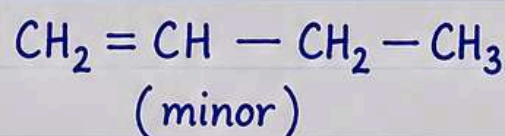
“The major product is obtained by the elimination of H^+ from that β -carbon of unsymmetrical alkyl halide which has the least no. of hydrogen.”

The major product is most substituted / more stable alkene called saytzeff product.

Example :



+



Saytzeff product

Q.2

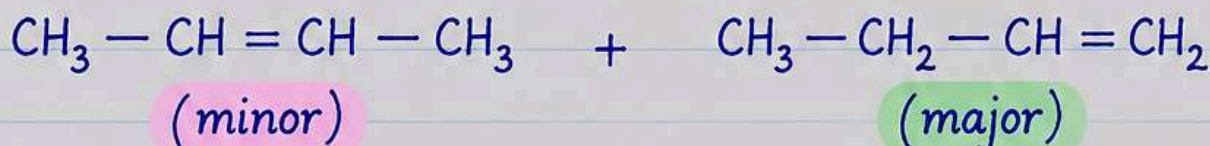
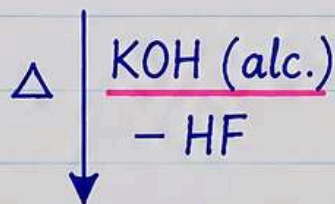
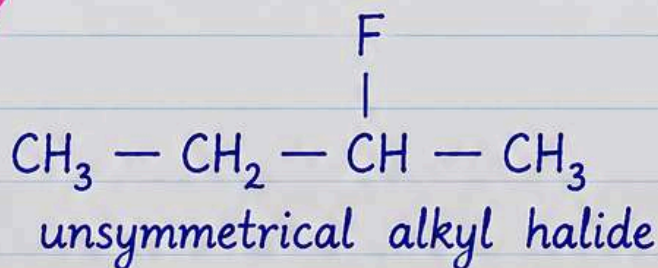
Hofmann Elimination Reaction for preparation of Alkene.

According to this rule :-

“ The major product formed by the elimination of H^+ from that β -carbon of unsymmetrical alkyl halide which have maximum number of hydrogen. ”

and the major product is least substituted alkene called as Hofmann product.

Example :



(Hofmann product)

Q.3

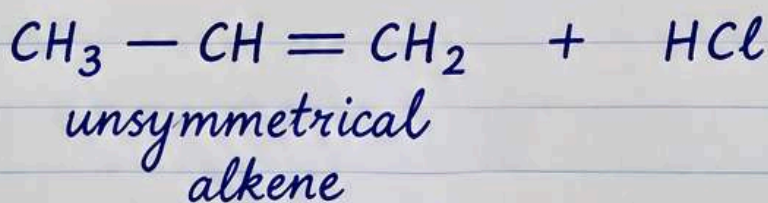
Markovnikov's Rule

It is given for the addition of HX to unsymmetrical alkene.

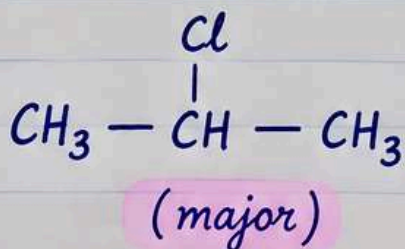
According to this rule :-

"In the addition of HX to unsymmetrical alkene, the H^+ of HX goes to that double bonded carbon which already has the greater no. of hydrogen atoms and vice-versa."

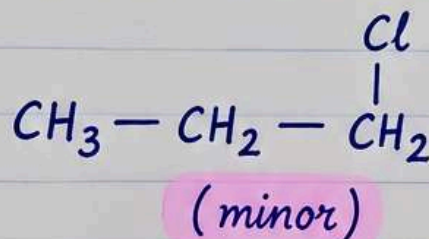
Example :-



Absence of catalyst



+



(Markovnikov's product)

Q.4

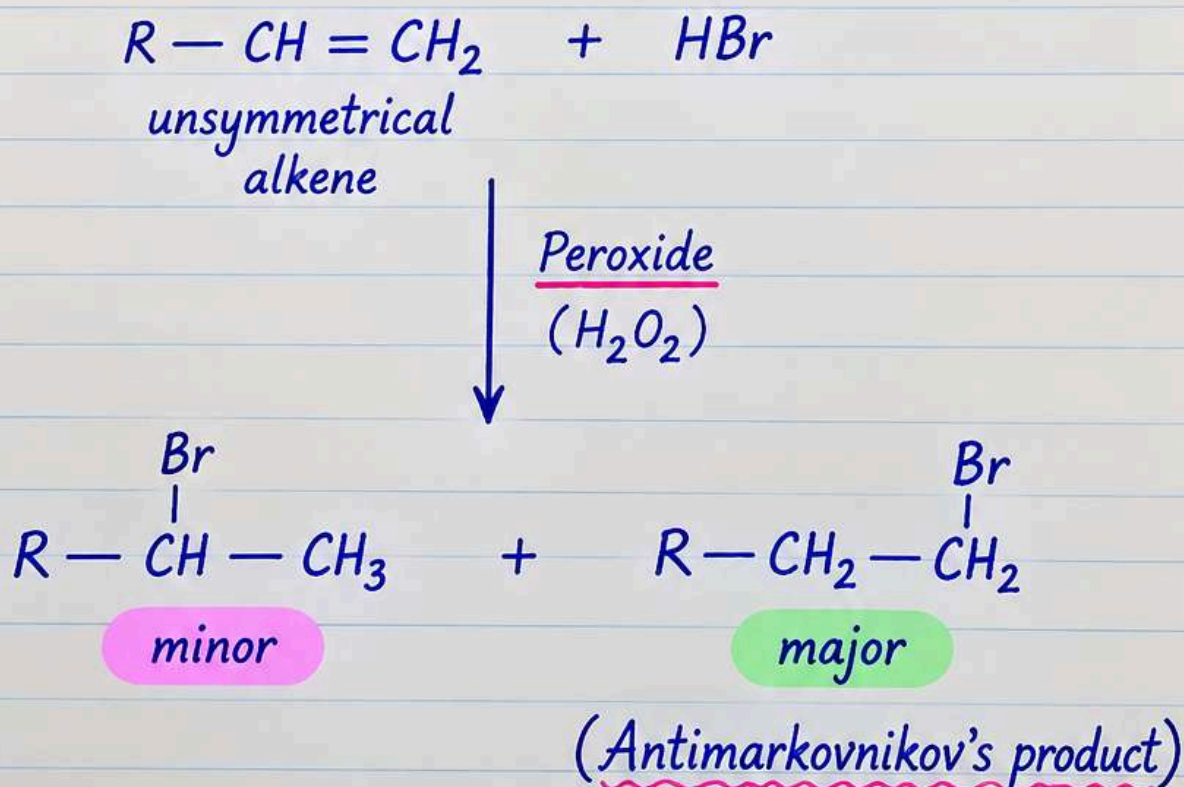
Antimarkovnikov's Rule / Peroxide Effect

It is given for the addition of HX to unsymmetrical alkene in presence of catalyst (peroxide).

According to this rule :-

“In the addition of HBr to unsymmetrical alkene, the +ve part (H^+) of HBr goes to that doubly bonded carbon atom which have least number of hydrogen to form major product and vice-versa.”

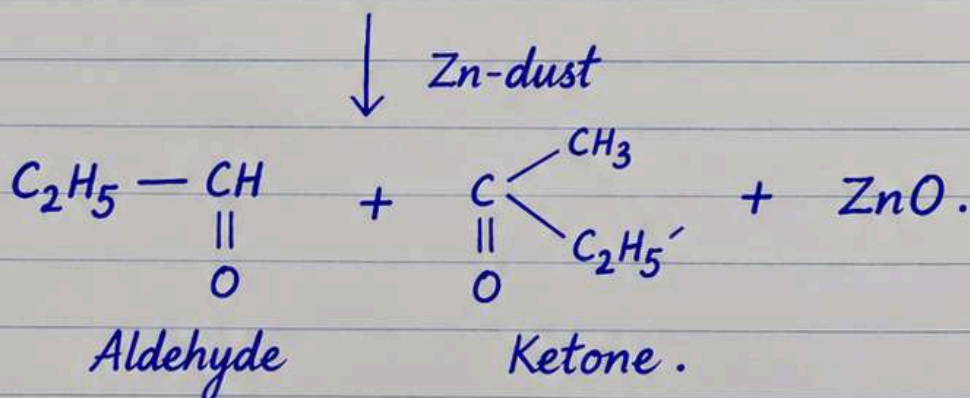
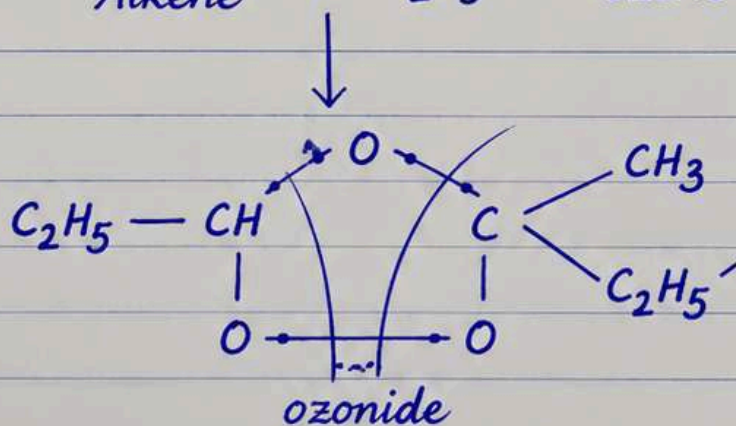
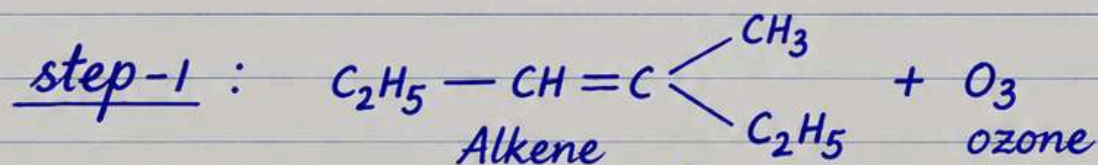
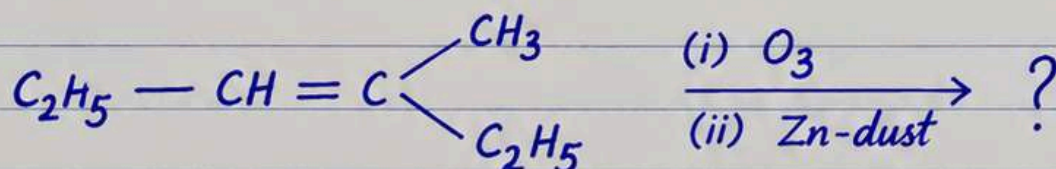
Example :



ozonolysis reaction of Alkene take place in two steps-

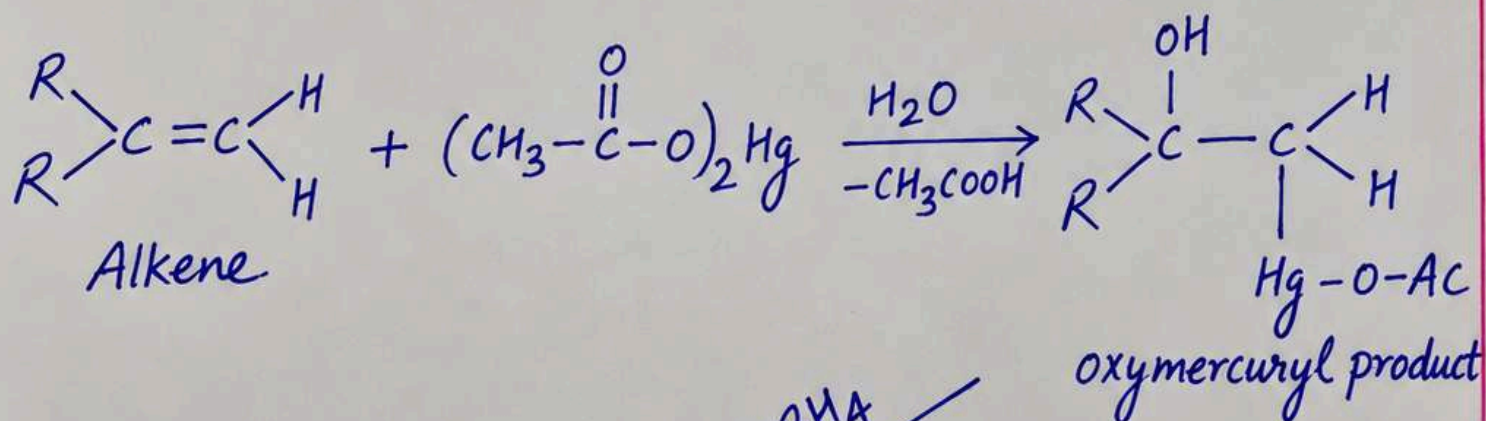
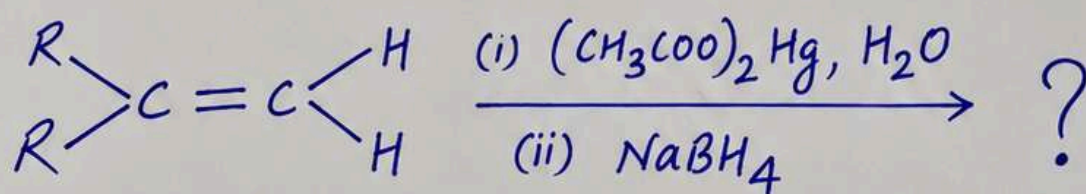
- i) step-I is the formation of ozonide.
- ii) step-II is the reaction of ozonide with Zn-dust to give carbonyl comp.

EX:

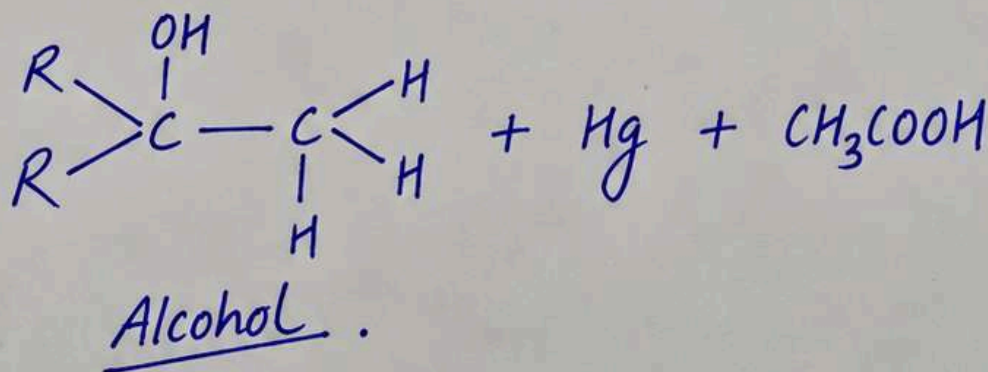


Q.6 $\Rightarrow$ Oxymercuration - Demercuration of Alkene.

In this reaction, Alkene react with mercuric Acetate (oxidation) followed by reduction with NaBH_4 (Demercuration) to give -

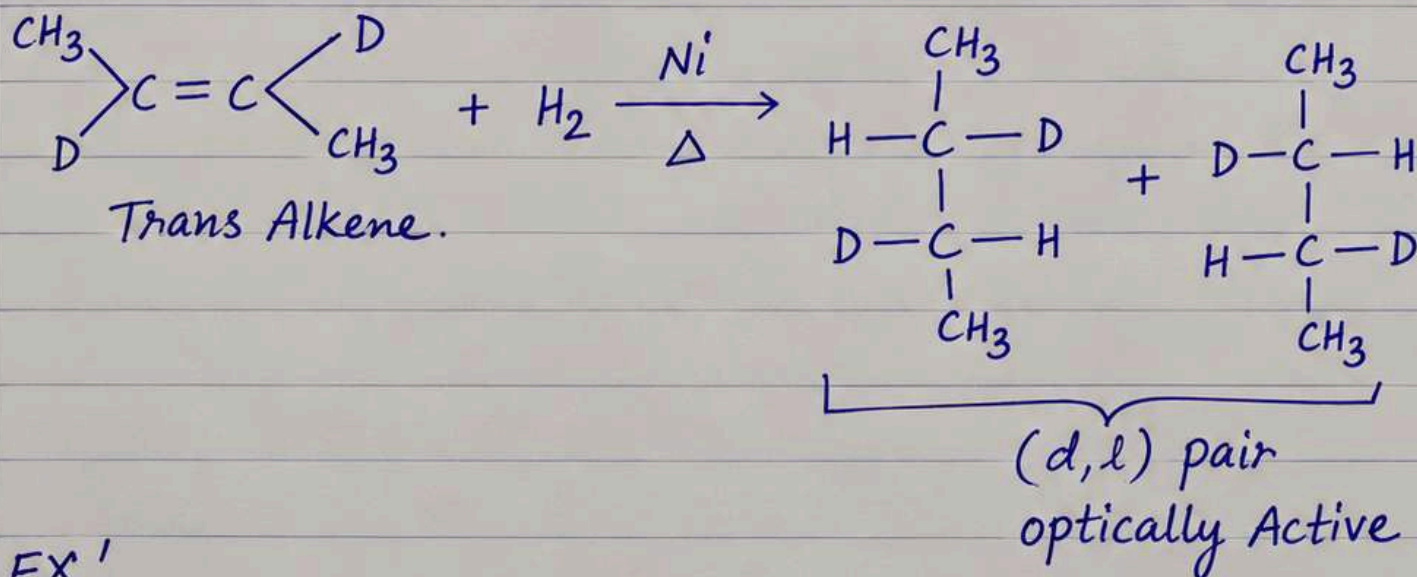
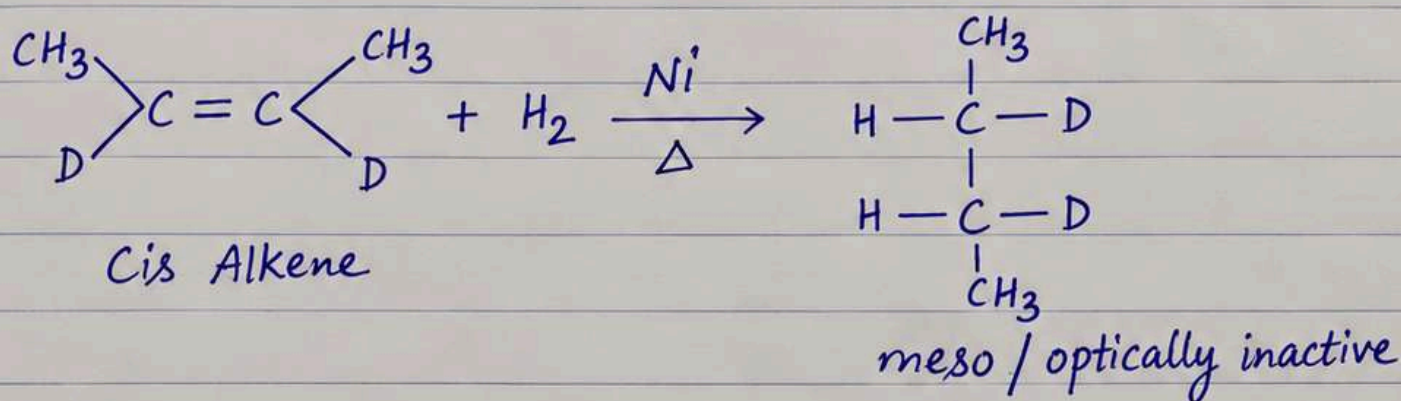


$\swarrow$ NaBH_4
reduction.



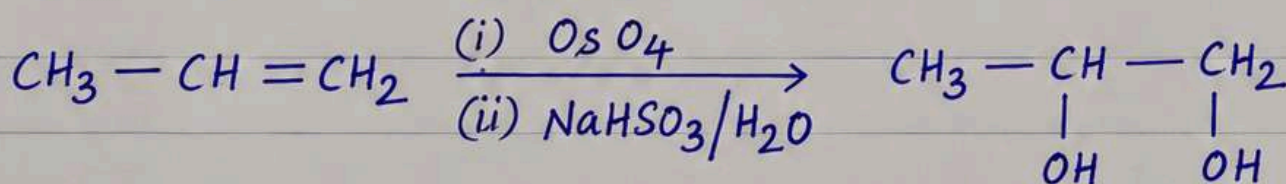
Q.7 $\Rightarrow$ Syn addition reaction of Alkene $\Rightarrow$

The catalytic hydrogenation of Alkene, in presence of Transition metal catalyst (Pt/pd/Ni) to give Syn addition reaction.



EX'

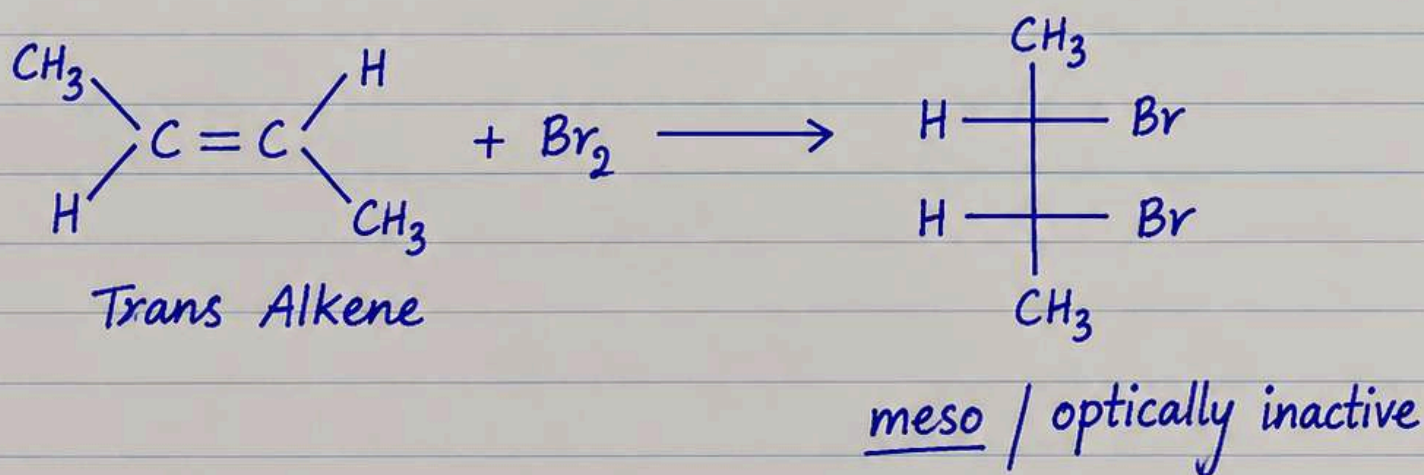
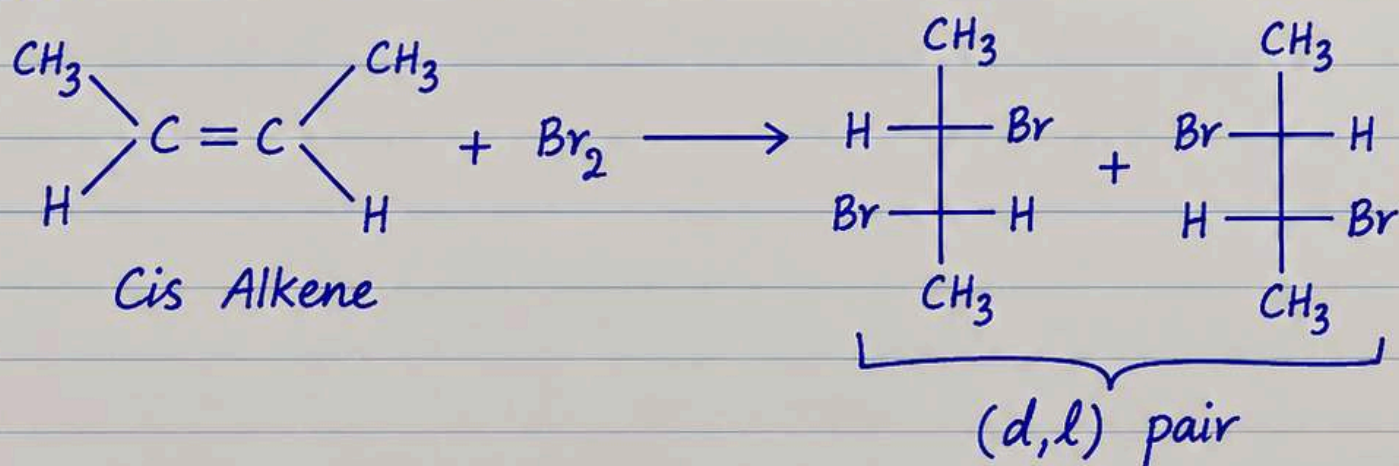
Syn dihydroxylation of Alkene



Q. 8 $\Rightarrow$ Anti addition Reaction of Alkene :-

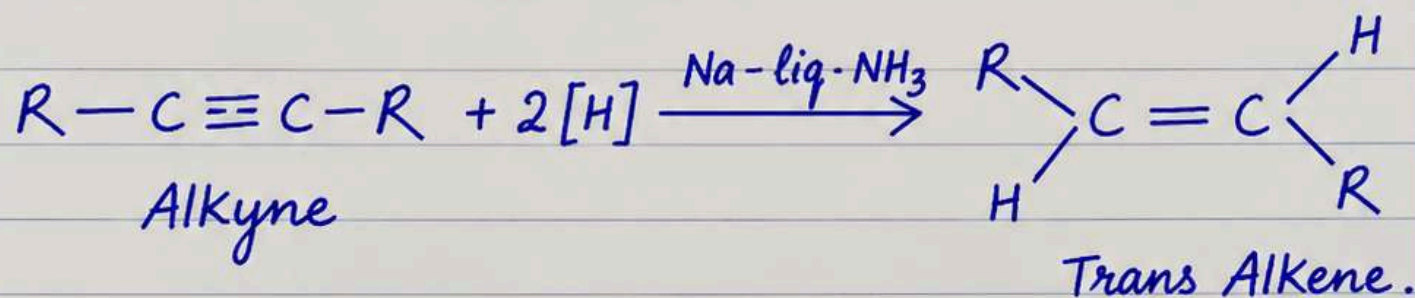
Br_2 react with Alkene through the Anti addition reaction. (halogenation reaction of Alkene).

EX:

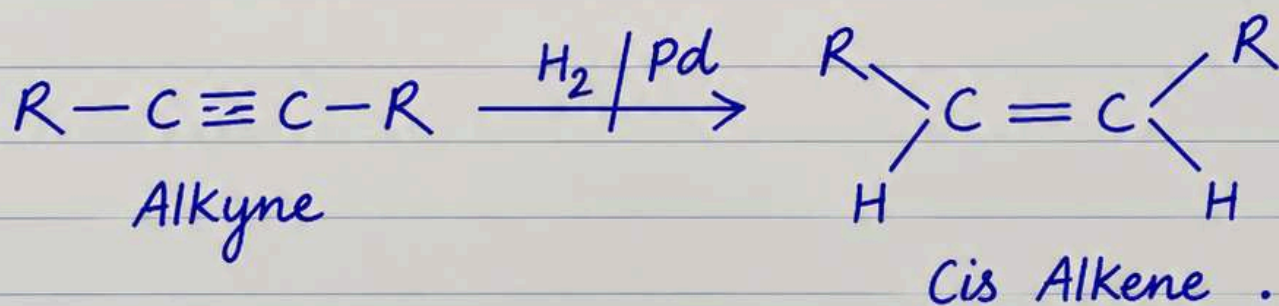


Q. 9 $\Rightarrow$ Reduction of Alkynes with -

(a) reduction with Na - liq. NH_3 (Birch Reduction).



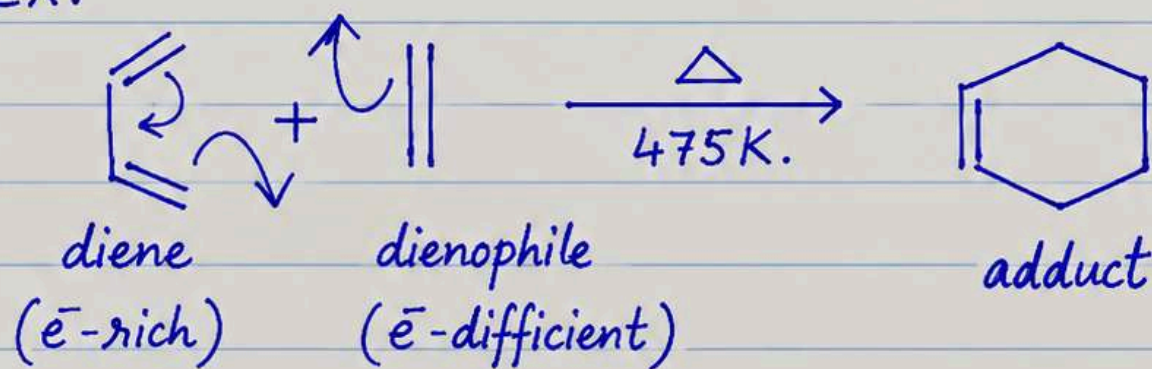
(b) reduction with $\text{H}_2/\text{Pd} \Rightarrow$



Q 10 $\Rightarrow$ Diels-Alder Reaction $\Rightarrow$

In absence of catalyst, the 1,4-addition reaction of 1,3-butadiene / conjugated diene with an Alkene / Alkyne called dienophile to give adduct.

EX:



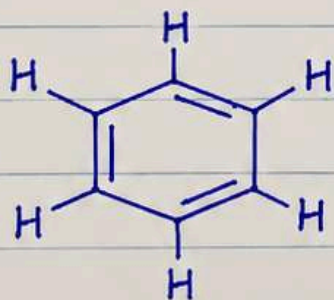
$\rightarrow$ The Diels-Alder Reaction is a concerted mechanism, proceed in single step.

$\rightarrow$ Diels-Alder Reaction is widely used in the synthesis of six membered ring compounds.

$\rightarrow$ There are no intermediate formed during the reaction.

Q 11 $\Rightarrow$ Preparation of Benzene $\Rightarrow$ C_6H_6 .

Sol. Benzene is a Aromatic compound, its Str. is given by Kekule.



molecule is —

$\Rightarrow$ cyclic, planer, conjugated.

$6\pi e^-$ $\Rightarrow$ follow Huckel $(4n+2)\pi e^-$ Rule.

$$(4n+2)\pi e^- = 6\pi e^-$$

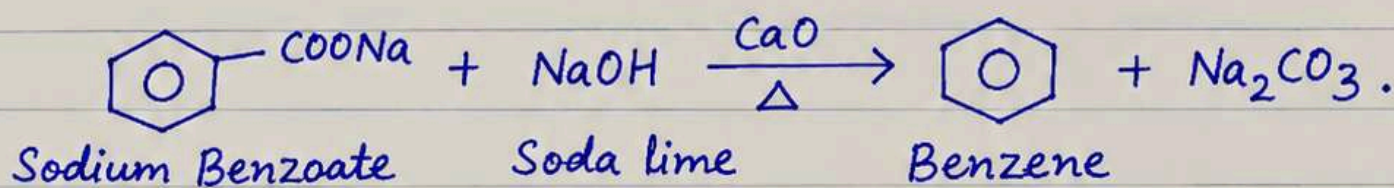
$$(4n+2) = 6$$

$$n = 1 \therefore \text{Aromatic comp.}$$

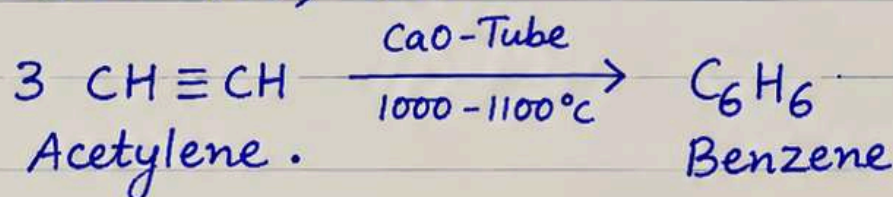
Preparation $\Rightarrow$

1) Lab method $\Rightarrow$

Sodium Benzoate react with soda lime ($NaOH + CaO$) to give Benzene.

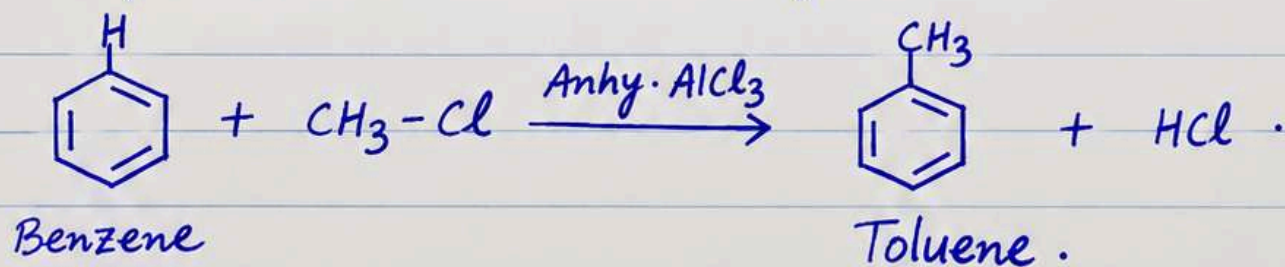


2) 3 mole of Acetylene Take on Red-Hot CaO Tube at $(\sim 1000 - 1100)^\circ C$.



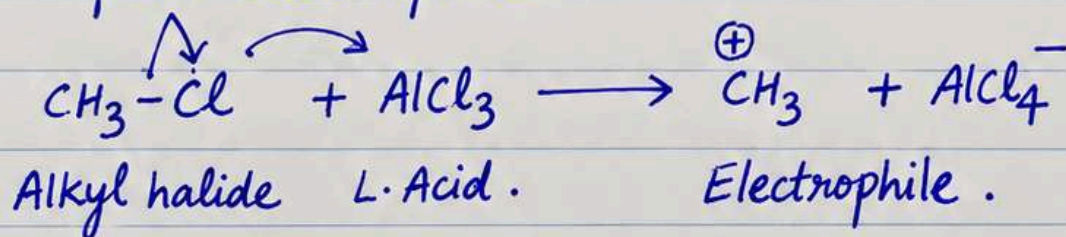
Q12 $\Rightarrow$ Friedel-Craft Alkylation of Benzene $\Rightarrow$

When Benzene react with $\text{CH}_3\text{-Cl}$, in presence of $\text{AlCl}_3 / \text{FeCl}_3$ (Lewis Acid) to form Toluene.

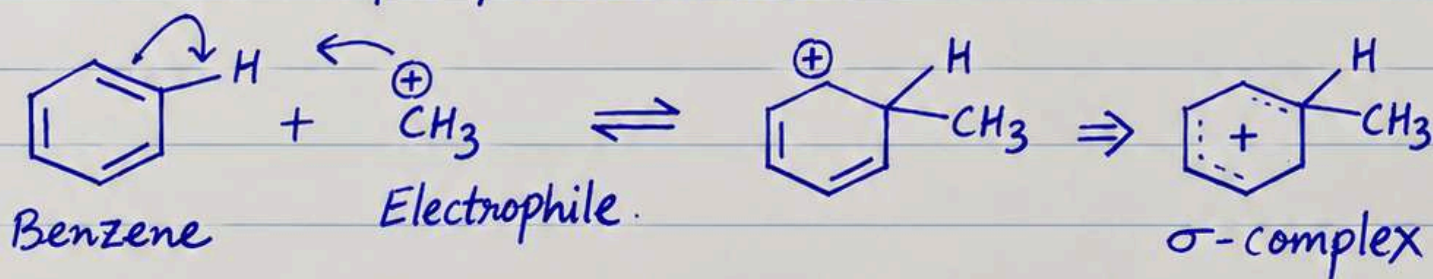


mechanism $\Rightarrow$

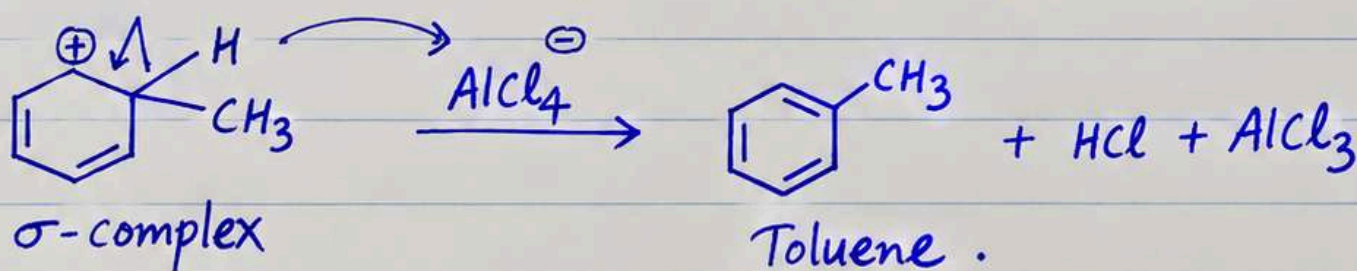
Step I: Breaking of $\text{CH}_3\text{-Cl}$ with Lewis Acid AlCl_3 to form Electrophile.



Step II: Electrophile attack on Benzene Ring to form σ -complex / carbonium ion.

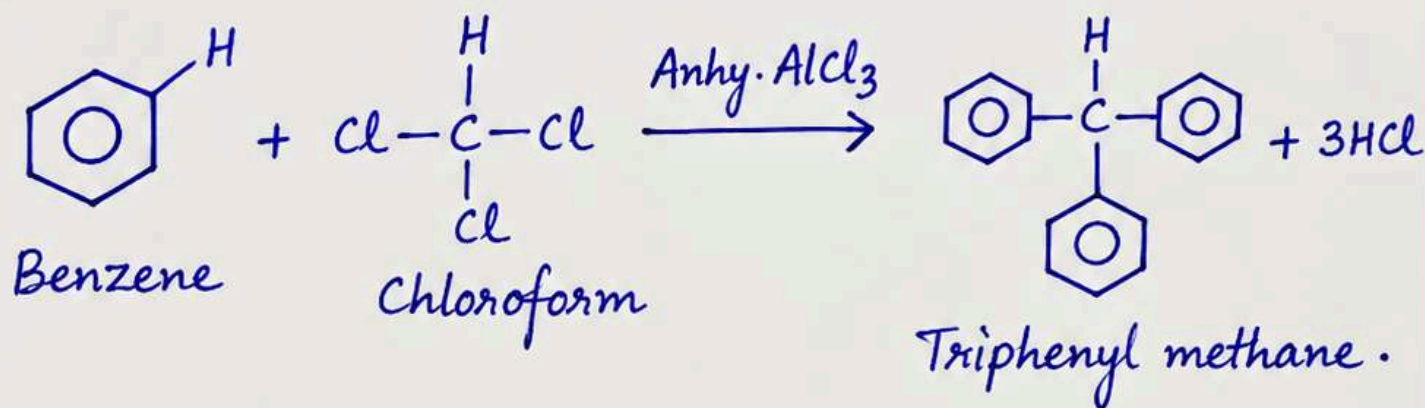


Step III: Deprotonation of σ -complex, to form Toluene.



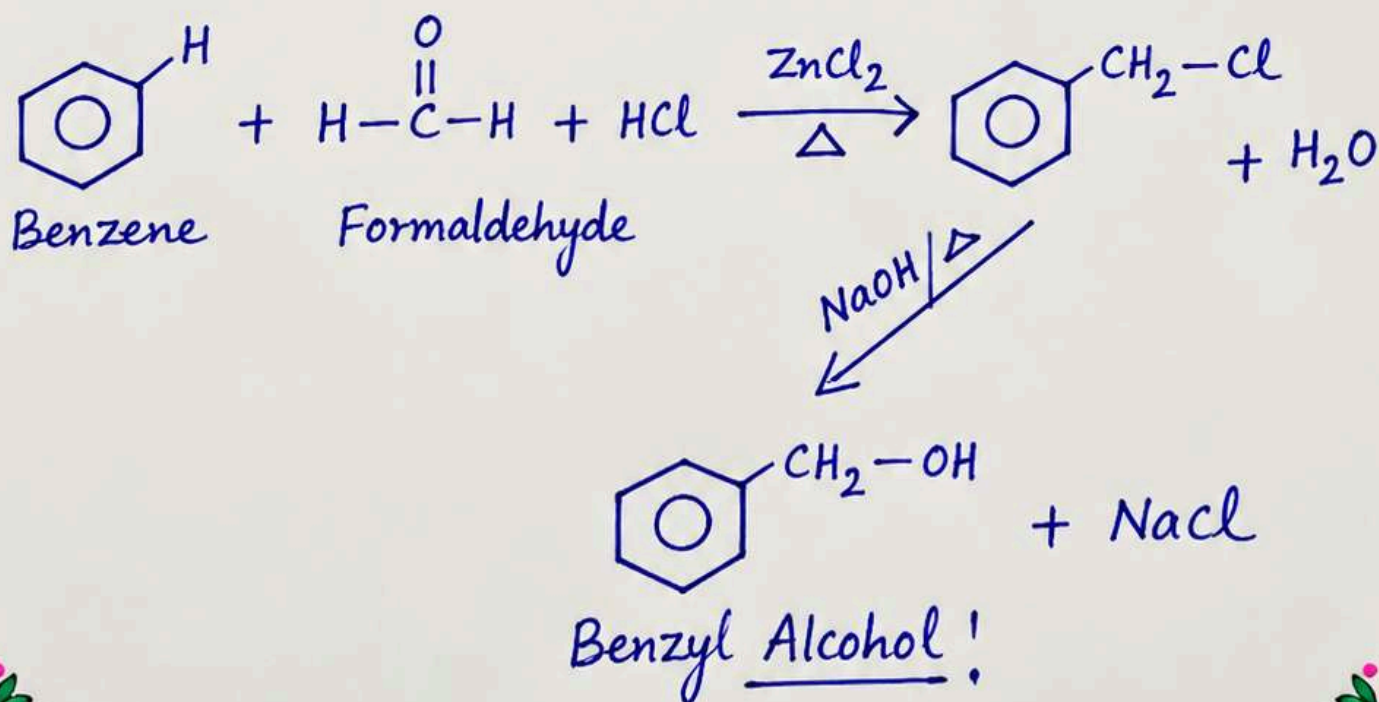
Q.13 $\Rightarrow$ Reaction of Benzene with chloroform $\Rightarrow$

Benzene react with CHCl_3 to give Triphenyl methane.



Q: Conversion of Benzene to Benzyl Alcohol $\Rightarrow$

Benzene react with H-CHO , in presence of ZnCl_2 to give Benzyl chloride, which on Hydrolysis with Base to give Benzyl Alcohol.



Q, 14 $\Rightarrow$ Activators and Deactivator group of Benzene Ring

Saturated group / Activators / o,p-Directors $\Rightarrow$

Those group which increases $\bar{e}$ density at ortho and para position of Benzene Ring. and Direct the Incoming group at o,p-position of Ring.

EX': $-\text{OH}$, $-\text{SH}$, $-\ddot{\text{X}}$, $-\text{NH}_2$, $-\text{NH}-\text{R}$, $-\ddot{\text{O}}\text{CH}_3$ etc.

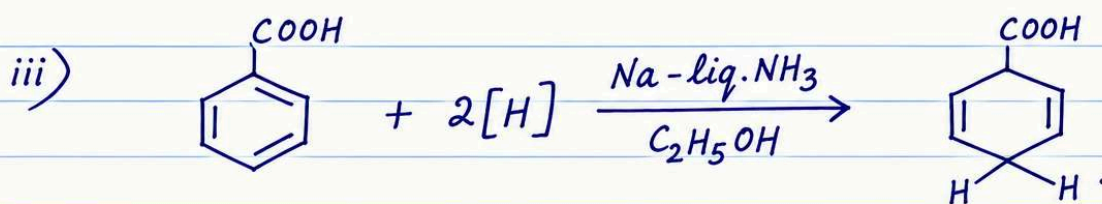
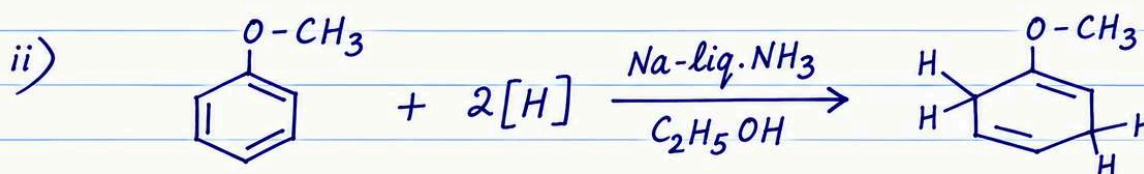
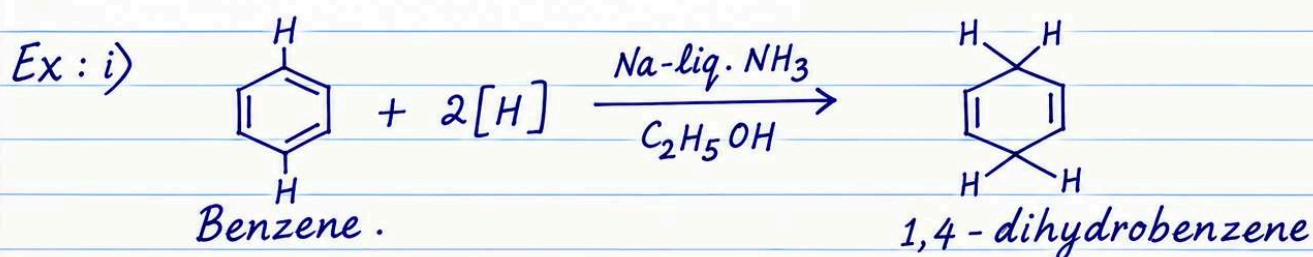
Unsaturated group / Deactivators / meta Directors $\Rightarrow$

Those group which decreases the $\bar{e}$ density at ortho and para position of Benzene Ring. Therefore, the remaining max $\bar{e}$ density at meta position, to Direct the Incoming group at meta position of Ring.

EX': $-\text{CHO}$, $-\text{COOH}$, $-\overset{\text{O}}{\parallel}\text{C}-\text{R}$, $-\overset{\text{O}}{\parallel}\text{C}-\text{NH}_2$, $-\text{SO}_3\text{H}$,
 $-\text{NO}_2$, $-\text{C}\equiv\text{N}$ etc.

Q.15 $\Rightarrow$ Birch Reduction / Reduction with Na - liq. NH_3

When benzene is reduced with Na - liq. NH_3 to give 1,4-dihydrobenzene. This reaction is called as Birch Reduction.





(a) oxidation with Acidic $\text{KMnO}_4 \Rightarrow$

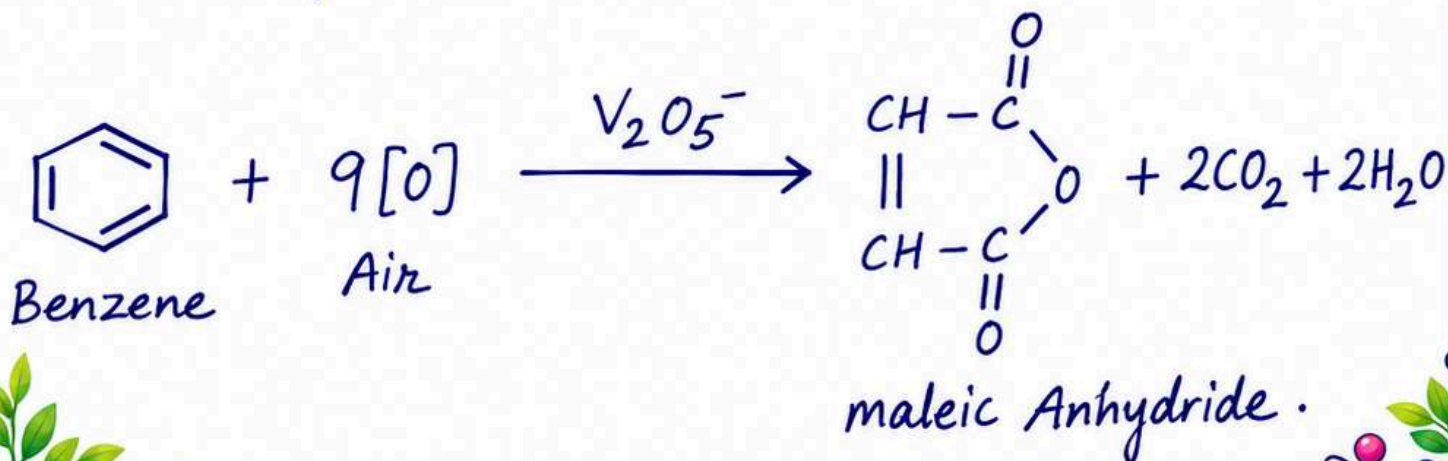
$$\text{Benzene} + 9[\text{O}] \xrightarrow{\text{KMnO}_4/\text{H}^+} \begin{array}{c} \text{CH}-\text{COOH} \\ || \\ \text{CH}-\text{COOH} \end{array} + 2\text{CO}_2 + \text{H}_2\text{O}$$

Air

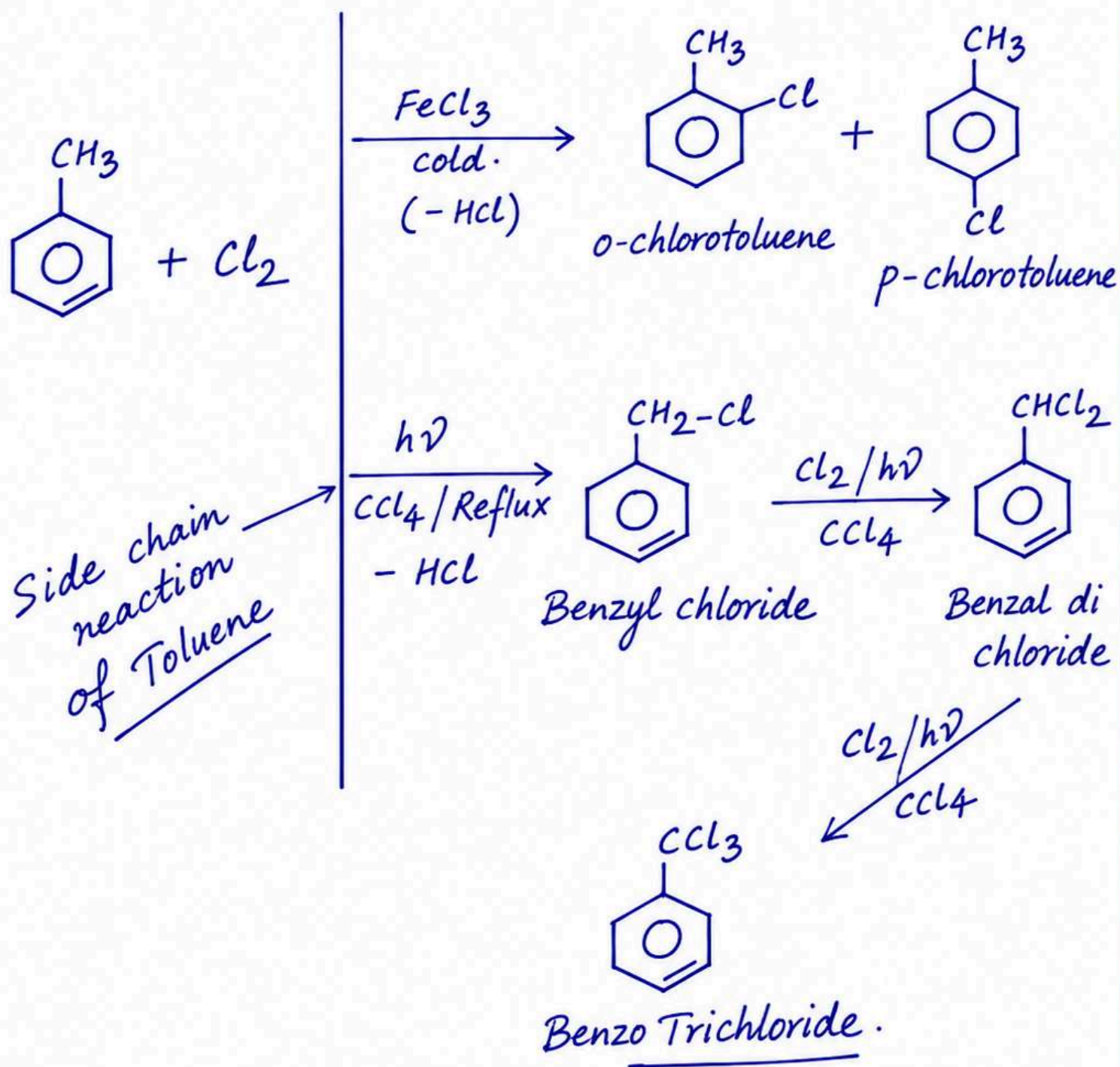
maleic Acid.

(b) oxidation with $V_2O_5^- \Rightarrow$

When Benzene is oxidised with V_2O_5 , to give maleic Anhydride.



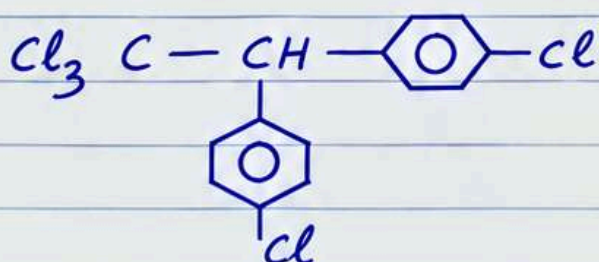
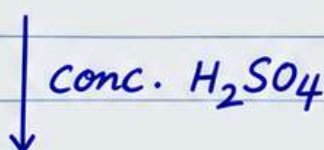
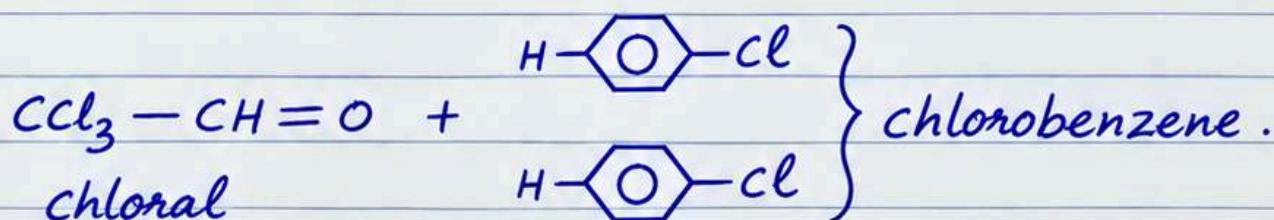
Q 18 $\Rightarrow$ Halogenation Reaction of Toluene $\Rightarrow$



Q. 19 $\Rightarrow$ write the preparation and properties of DDT.

Sol:- DDT. / Dichlorodiphenyl Trichloroethane : $\Rightarrow$

it is prepared by the condensation reaction of two molecule of chlorobenzene with chloral, in presence of conc. H_2SO_4 .



DDT.

(p, p'-dichlorodiphenyl Trichloroethane.)

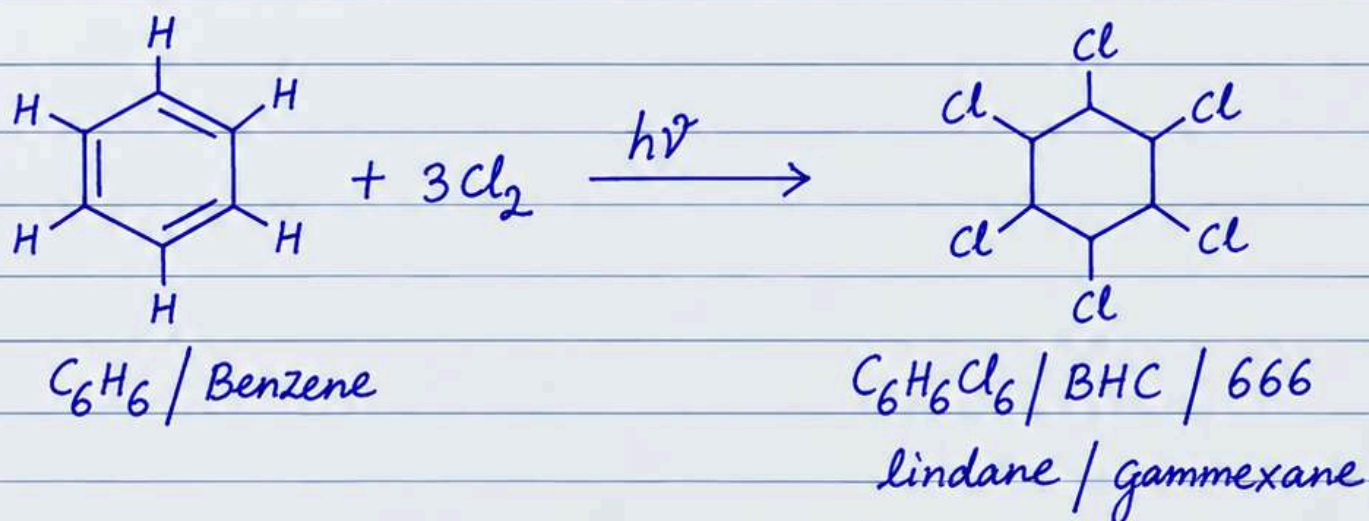
uses $\Rightarrow$

- i) it is used as Insecticides.
- ii) DDT is not Biodegradable.
- iii) it is Toxic for living beings.

Q. 20 write the preparation and properties of BHC

sol: Benzene Hexa chloride (BHC) $\Rightarrow$

it is prepared by the chlorination of Benzene, in presence of Sun light ($h\nu$). in which ~~(#)~~ of the Benzene are Break and give addition Reaction.



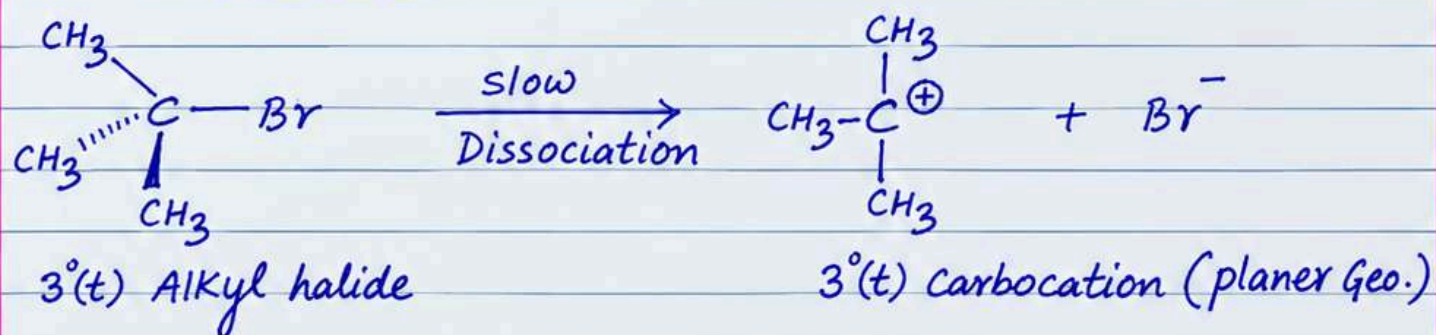
* BHC is used as ~~pesticides~~ pesticides. in Agriculture under the Trade name gammexane / lindane.

Q. 21' Explain S_N1 -mechanism with Example $\Rightarrow$

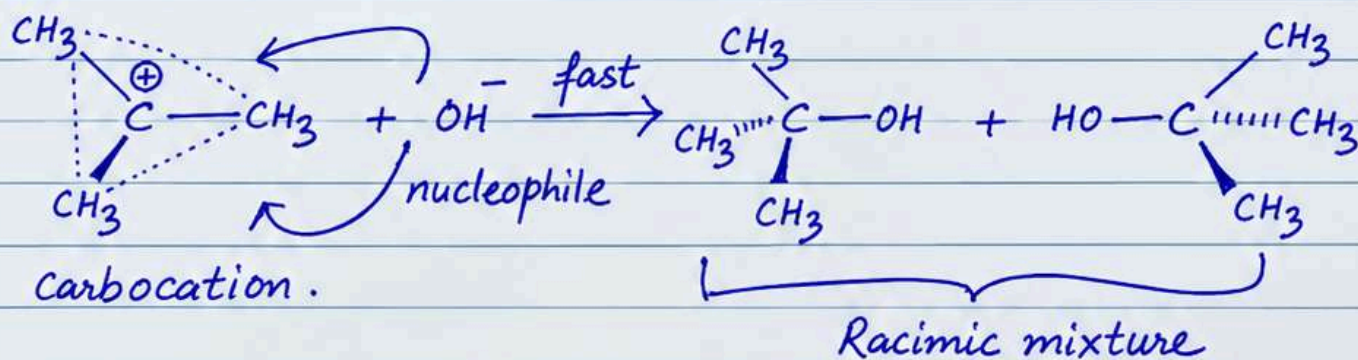
Sol $\Rightarrow S_N1$ -Reaction / unimolecular nucleophilic sub. Reaction.

The hydrolysis of t-Butyl Bromide with aqu. NaOH, involves two steps -

Step I: The Alkyl halide ionise to give $3^\circ(t)$ -planer carbocation.



Step II: The nucleophile attack on The planer carbocation from both side to give Racimic mixture (R+S)



$\hookrightarrow$ In The S_N1 -reaction, Racimisation Take place.

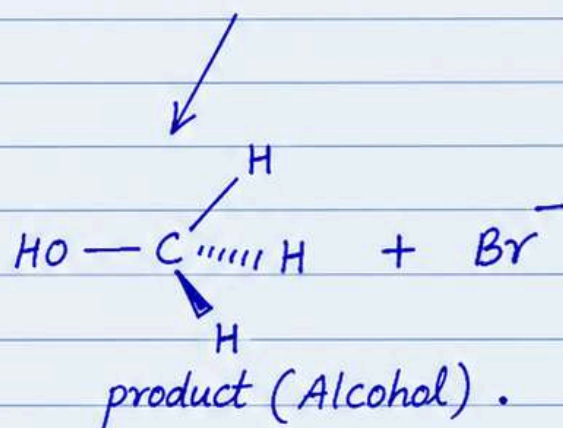
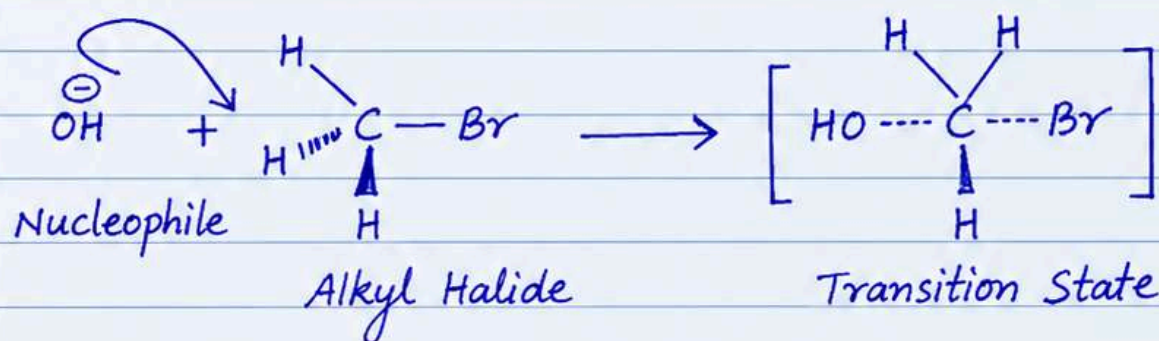
$\hookrightarrow 3^\circ(t)$ Alkyl halide give S_N1 -Reaction.

$\hookrightarrow \text{rate}(r) \propto [\text{Alkyl halide}]$.

Q. 22 SN^2 -Reaction / Bimolecular Nucleophilic Substitution R_X^n :

Sol. → In the SN^2 -Reaction, the attack of nucleophile and the ejection of the Halide ion take place - Simultaneously in this situation, ~~a~~ Transition State is formed.

Exp. Hydrolysis of CH_3-Br with $NaOH(aq.)$.



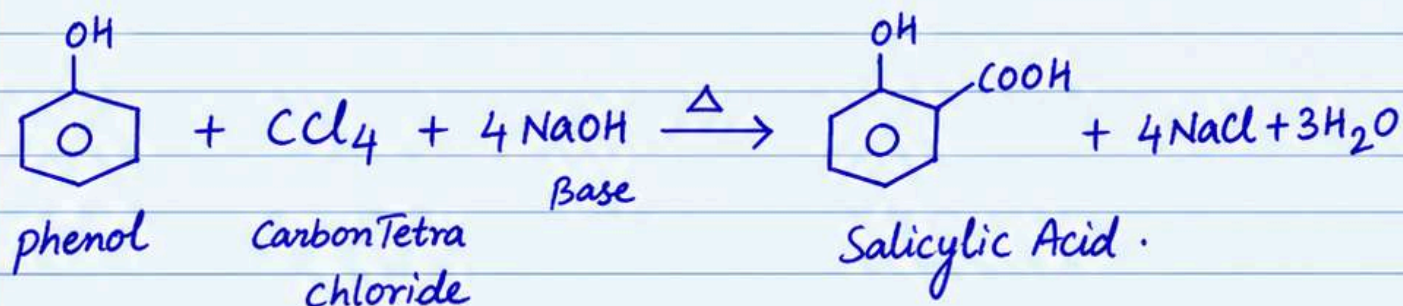
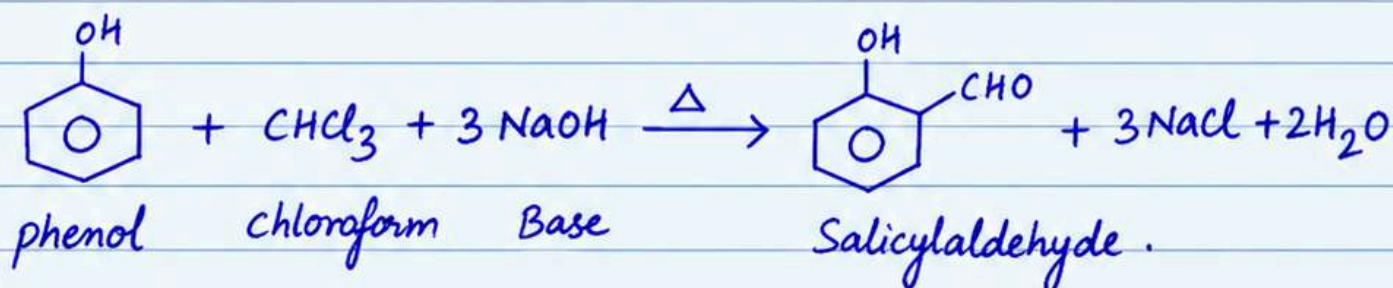
→ In SN^2 -Reaction, Inversion of configuration Take place .

→ $1^\circ(P)$ Alkyl Halide give SN^2 -Reaction .

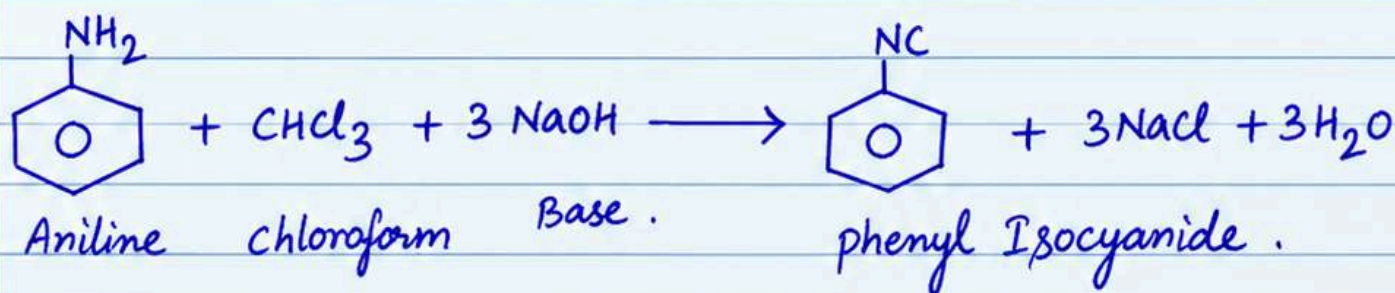
→ rate (r) $\propto$ [Alkyl Halide] [Nucleophile] .

Q. 24 Reimer-Tiemann Reaction $\Rightarrow$

phenol is react with CHCl_3 and NaOH (Base) to give Salicylaldehyde.

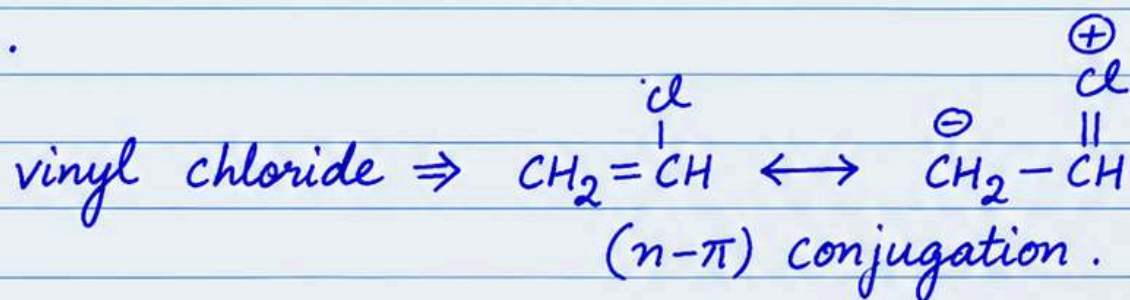
Q. 25 Carbyl Amine Reaction $\Rightarrow$

Aniline react with chloroform and NaOH to give bad smell comp. called phenyl Isocyanide.



Q 26 Explain why Allyl halide are more reactive than the Vinyl halide. ?

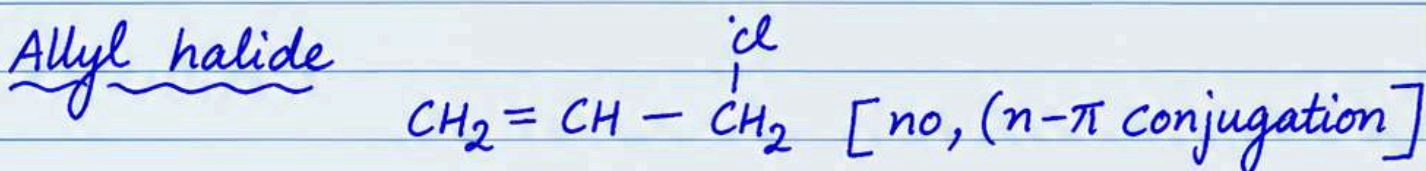
Sol.



The Cl atom in vinyl chloride is relatively Inert and does not give Substitution reaction due to posses same double bond character of (C=C) bond.



Allyl halide

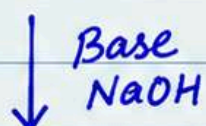
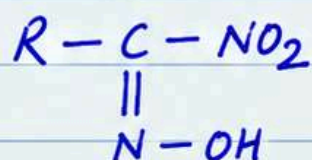
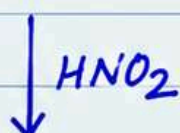
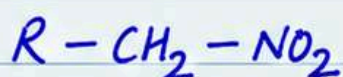
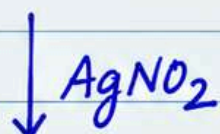
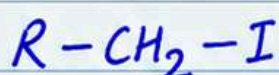
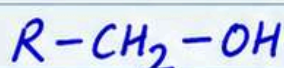


Allyl halide are more reactive because the lonepair does not Interact with π -bond in Allyl halide.

Q. 27 Victor-meyer' Test $\Rightarrow$

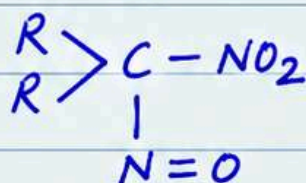
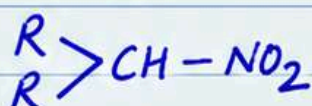
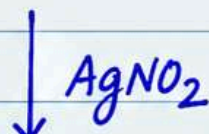
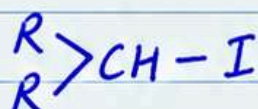
This Test is used to Distinguish b/w 1° , 2° & 3° Alcohol.

$1^\circ(P)$ Alcohol



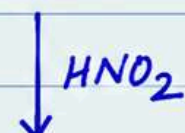
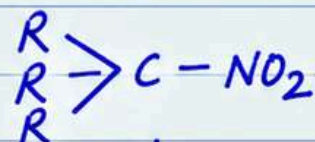
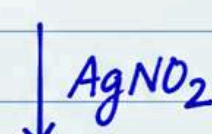
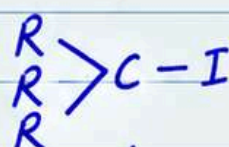
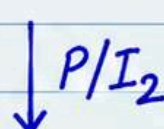
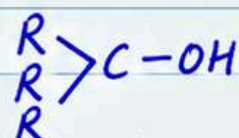
Red colour

$2^\circ(S)$ Alcohol

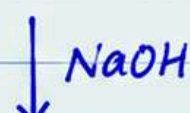


Blue colour

$3^\circ(t)$ Alcohol.

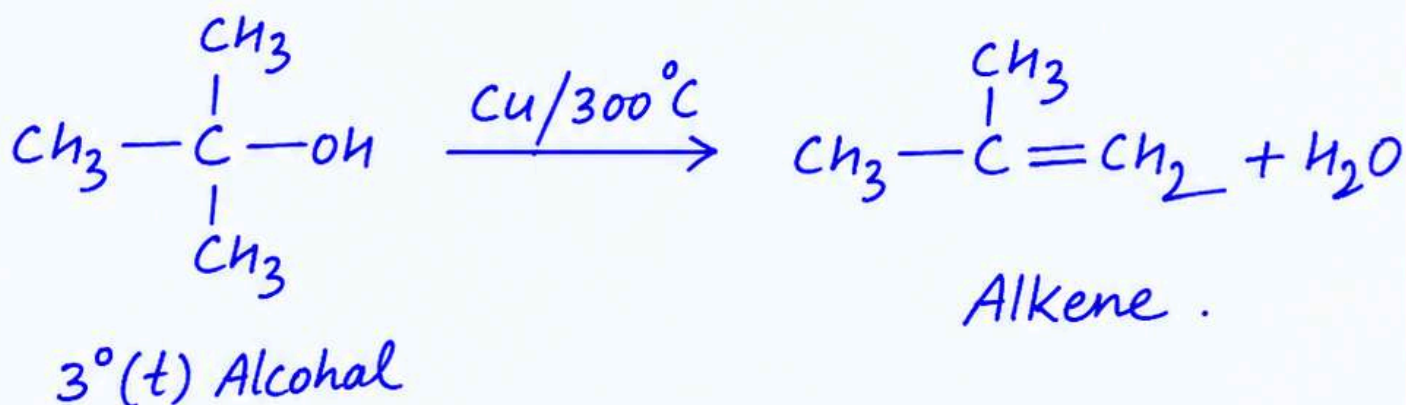
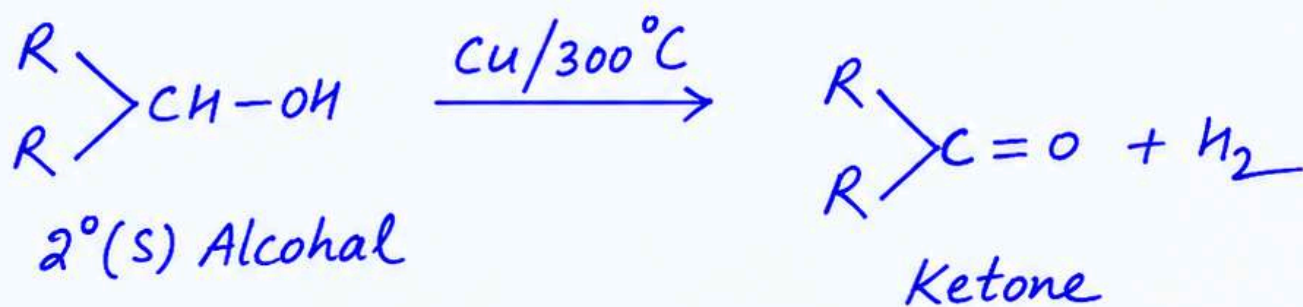
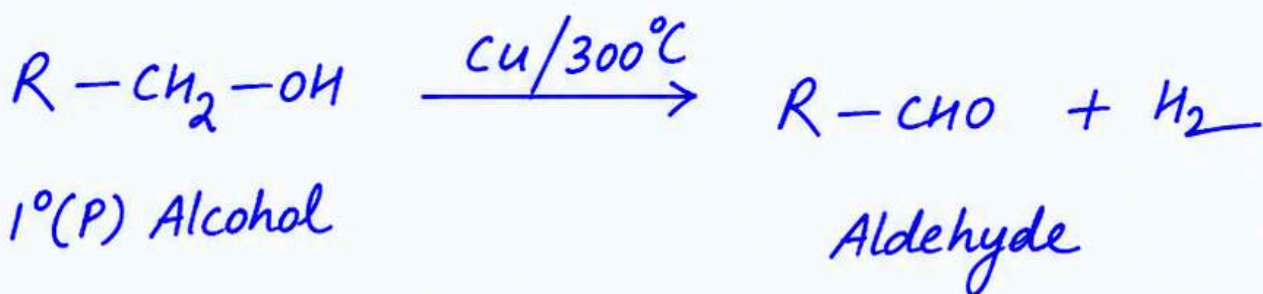


No Reaction.



colour less.

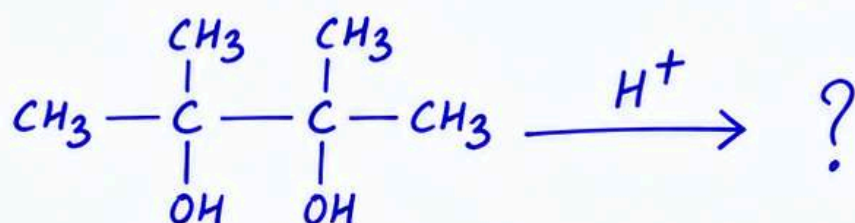
Q. 28 Dehydrogenation Reaction of Alcohol.



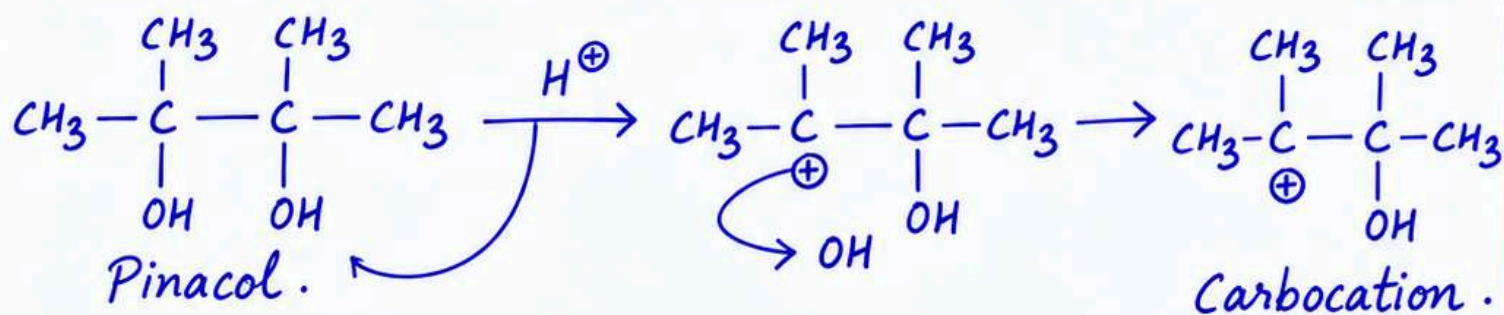
Q. 29

Acid catalysed Rearrangement of glycol.
or
Pinacol - Pinacolone Rearrangement $\Rightarrow$

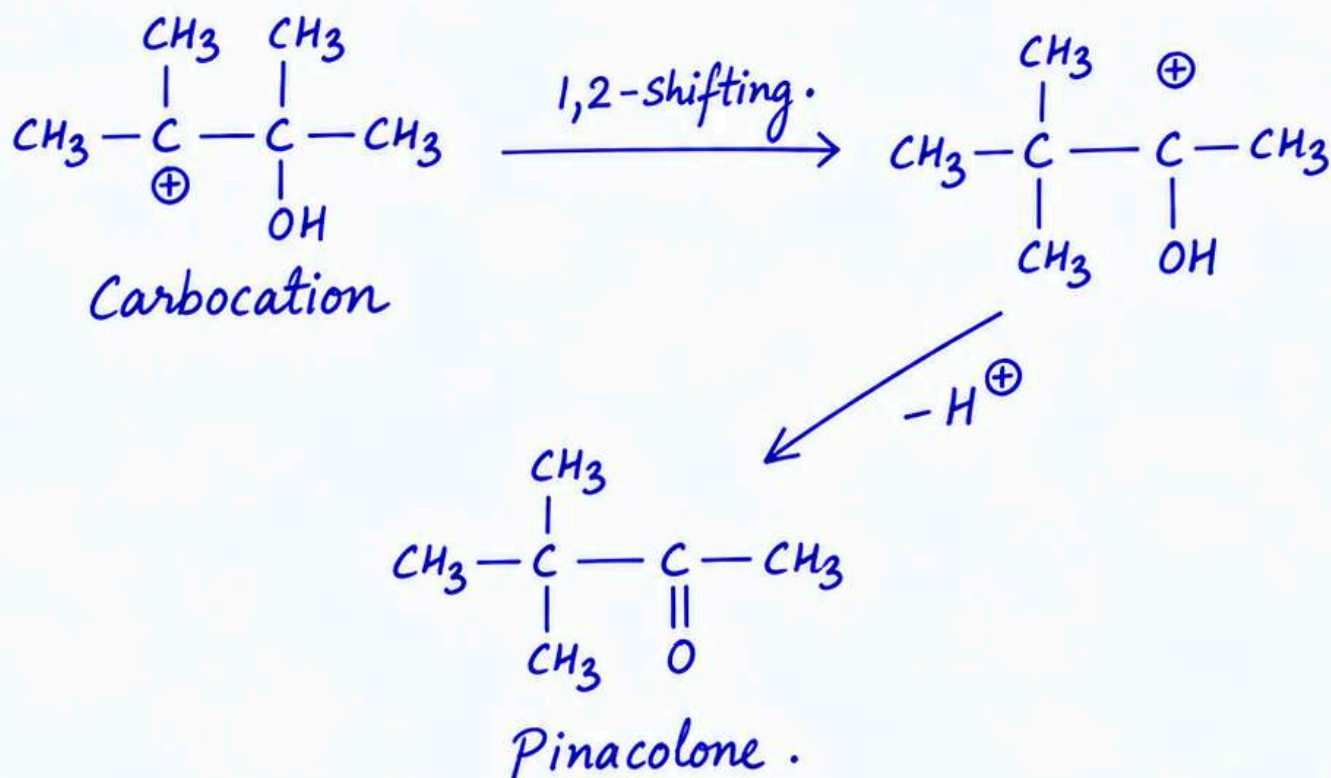
Sol.



Step I : formation of more stable carbocation.



Step II : Rearrangement of group / 1,2-Shifting of group.



Q.32. Discuss the organometallic compounds with suitable examples.

Introduction :

Organometallic compounds are compounds which contain at least **one direct bond** between a **carbon atom** of an organic group and a **metal atom**.

General Characteristics :

- They contain a **carbon-metal bond**.
- They show both **organic** and **metallic** character.
- Mostly formed with **electropositive metals**.
- They are used as **reagents** in **organic synthesis**.

Types :

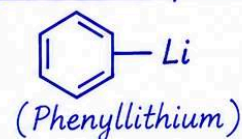
- (i) **σ -Bonded organometallic compounds**
(direct C-M σ bond, e.g. alkyl and aryl metal compounds).
- (iii) **π -Bonded organometallic compounds**
(where metal is bonded to π -electrons of unsaturated systems, e.g. alkenes, arenes, etc.).

Examples :

- **Alkyl metal compound :**



- **Aryl metal compound :**



- **Metal carbonyl :**



- **π -complex compound :**

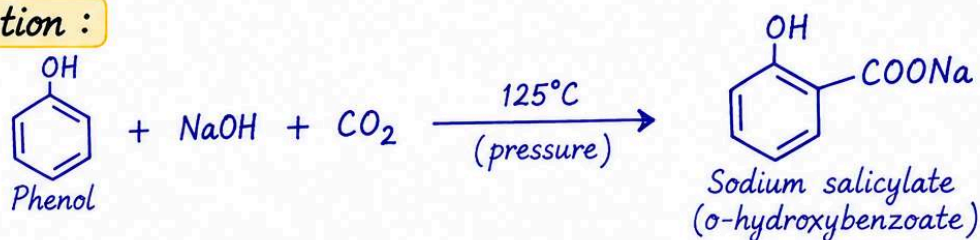


Q.32. Describe the Kolbe reaction in phenol with mechanism.

Introduction :

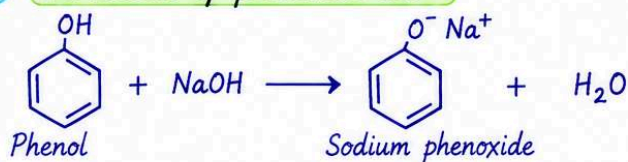
When phenol is treated with sodium hydroxide and carbon dioxide at about 125°C under pressure, it gives **sodium salicylate**. This reaction is called **Kolbe reaction**.

Overall Reaction :

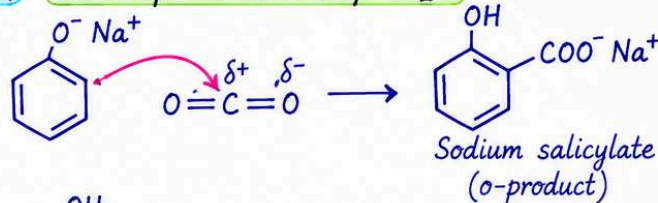


Mechanism :

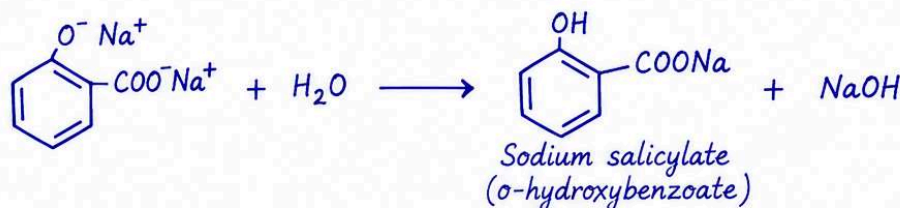
(i) Formation of phenoxide ion :



(ii) Electrophilic attack of CO₂ :



(iii) Protonation :

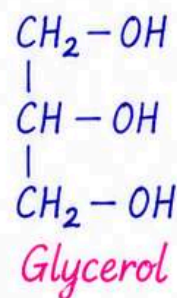


Q.33.

Give the method of preparation and usage of glycerol.

Introduction :

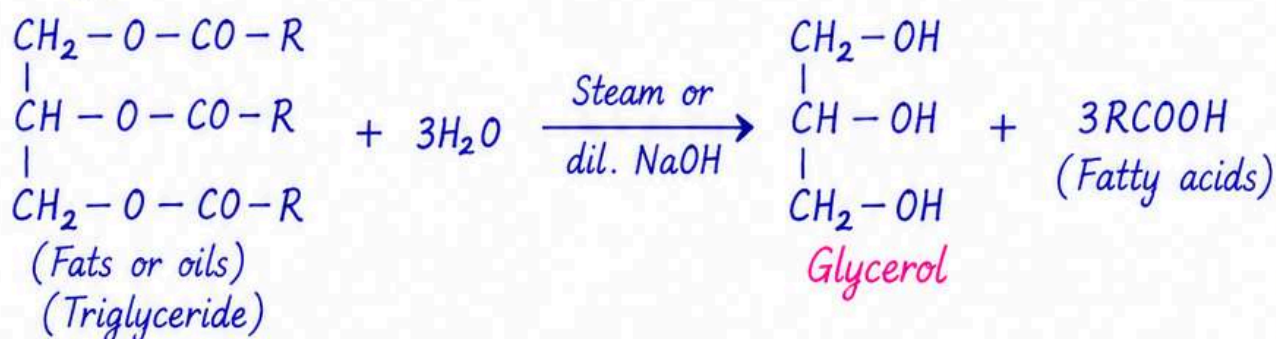
Glycerol (glycerine) is a **trihydric alcohol** having three $-OH$ groups. Its chemical name is **propane-1,2,3-triol** and its molecular formula is $C_3H_8O_3$.



Methods of Preparation :

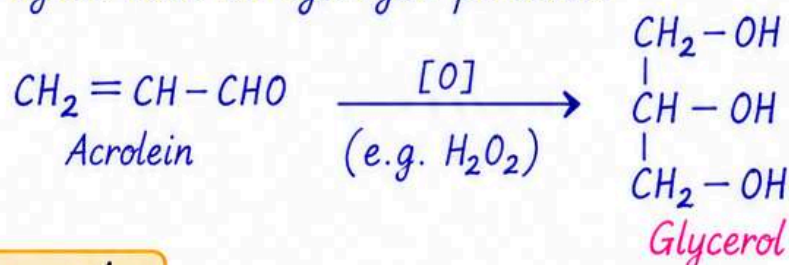
1 From natural fats and oils (Hydrolysis) :

Glycerol is obtained as a **by-product** in the hydrolysis of fats and oils (triglycerides) with steam or dilute alkali.



3 From acrolein (via oxidation) :

Glycerol can be prepared by the oxidation of acrolein with a suitable oxidising agent such as hydrogen peroxide.



Uses of Glycerol :

- 1 In the manufacture of **nitroglycerine** (used in explosives).
- 2 As a **humectant** in cosmetics, creams and lotions (keeps skin moist).
- 3 In the preparation of **alkyd resins** and **plastics**.
- 4 As a **solvent** for drugs, dyes, flavours and essential oils.
- 5 In the manufacture of **glycerol mono- and di-esters** (emulsifiers) used in food and pharmaceutical products.
- 6 As an **antifreeze** in automobile radiators.

Q.34.

Explain the Zeisel's method.

Introduction :

Zeisel's method is used for the estimation of **methoxy** ($-OCH_3$) groups present in organic compounds such as ethers, esters, etc. In this method, the compound is heated with **hydriodic acid** (HI) and the methoxy group is converted into **methyl iodide** (CH_3I), which is passed into alcoholic silver nitrate solution to form a yellow precipitate of **silver iodide** (AgI). From the amount of AgI , the number of methoxy groups can be calculated.

Formula :

No. of methoxy group =

$$\frac{\text{wt. of AgI} \times \text{mw. of compound}}{\text{mw. of AgI} \times \text{wt. of compound}}$$

Reaction :

1 Cleavage of methoxy group with HI :

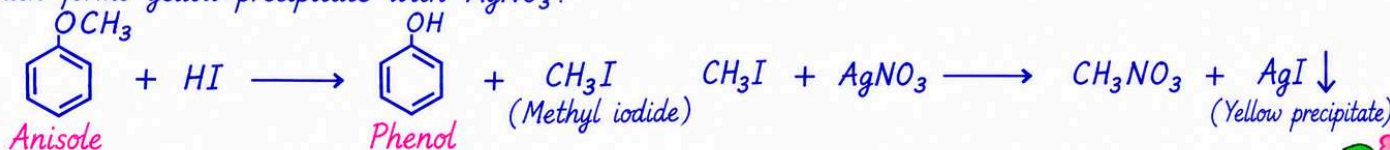


2 Formation of silver iodide :



Example :

Anisole (methoxybenzene) gives methyl iodide on treatment with HI, which forms yellow precipitate with $AgNO_3$.



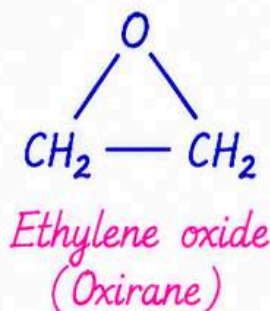
Q.35.

What are epoxides, give one method of their preparation. Also, its uses.

Epoxides :

Epoxides are *three-membered cyclic ethers* in which an oxygen atom is linked to two adjacent carbon atoms forming a triangular ring. They are also called *alkylene oxides or oxiranes*. The simplest epoxide is ethylene oxide (oxirane). Epoxides are highly *reactive* due to ring strain and readily undergo ring-opening reactions with nucleophiles.

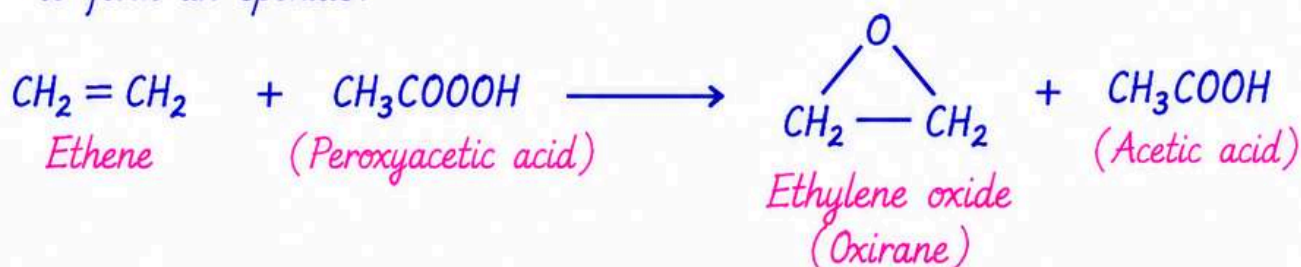
General structure :



Method of Preparation :

1 Epoxidation of alkenes (using peroxy acids) :

Alkenes react with a peroxy acid such as *peroxyacetic acid* (CH₃COOOH) to form an epoxide.



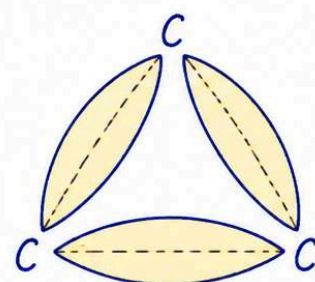
Uses of Epoxides :

- 1 Ethylene oxide is used in the manufacture of *ethylene glycol*, which is used as an *antifreeze*.
- 2 Epoxides are used in the preparation of *alcohols*, *diols* and other organic compounds.
- 3 Propylene oxide is used to make *polyols*, which are used in *polyurethane plastics*, *foams* and *resins*.
- 4 Epoxides are used as intermediates in the synthesis of *pharmaceuticals*, *detergents* and *surface-active agents*.
- 5 Ethylene oxide is used as a *sterilising agent* for medical equipment and food products.

Q.36. Explain the three banana bonds in cyclopropane.

Introduction :

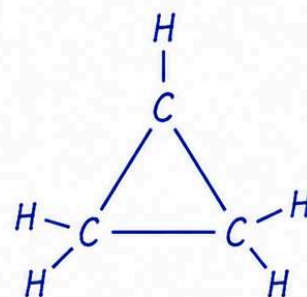
Cyclopropane (C_3H_6) is a *three-membered* ring in which the bond angle is only 60° . In order to reduce the angle strain, the C-C bonds do not remain as normal straight σ -bonds. Instead, the side-wise overlap of the bent σ -orbitals on adjacent carbon atoms gives rise to three banana bonds. These are called *banana bonds* because the overlapping electron cloud is like a banana, bent above and below the C-C axis. Thus, cyclopropane contains three banana bonds, one between each pair of adjacent carbon atoms.



Three banana bonds in cyclopropane.

Features of banana bonds :

- 1 There are *three banana bonds* in cyclopropane, one between each pair of carbon atoms.
- 2 They are formed by *side-wise overlap* of bent σ -orbitals on adjacent carbon atoms.
- 3 The electron cloud of each bond is *bent above and below* the line joining the two carbon atoms, giving a banana shape.
- 4 These bonds are *weaker* than normal C-C σ -bonds and are responsible for the *high ring strain* and high reactivity of cyclopropane.



Structure of cyclopropane (C_3H_6)

Q.37.

Explain the Baeyer strain theory for stability of cycloalkane.

Introduction :

Baeyer strain theory was given by **Adolf von Baeyer (1885)** to explain the stability of cycloalkanes. According to this theory, cycloalkanes are assumed to be **planar rings** and the carbon atoms are **sp^3 hybridised** with a normal tetrahedral bond angle of **109.5°** . However, in a planar ring the C-C-C bond angle is different from **109.5°** , which leads to **angle strain** or **Baeyer strain**. The greater the deviation from **109.5°** , the greater is the strain and the **lower is the stability** of the cycloalkane.

Baeyer strain :

The extra strain present in cycloalkanes due to deviation of the C-C-C bond angle from the normal tetrahedral angle (109.5°) is called **Baeyer strain** or **angle strain**.

Calculation of Baeyer strain :

The strain can be calculated from the deviation of the bond angle in a regular polygon from the tetrahedral angle (109.5°). For a regular n -membered ring, the internal bond angle is

$$\text{Internal bond angle} = \frac{(n-2) \times 180^\circ}{n}$$

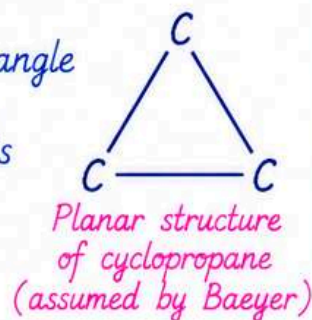


Table : Baeyer strain in cycloalkanes

Ring size (n)	Structure (planar ring)	Internal bond angle ($^\circ$)	Deviation from 109.5° ($^\circ$)	Baeyer strain ($^\circ$)	Stability
3		60°	49.5°	49.5°	Least stable
4		90°	19.5°	19.5°	Less stable
5		108°	1.5°	1.5°	More stable
6		120°	10.5°	10.5°	Stable
7		128.6°	19.1°	19.1°	Less stable
8		135°	25.5°	25.5°	Less stable

Conclusion :

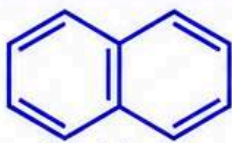
According to Baeyer strain theory, cycloalkanes with bond angles close to 109.5° have **less strain** and are **more stable**. Thus, cyclopropane (highest strain) is **least stable**, cyclohexane (minimum strain) is **most stable** among the simple cycloalkanes.

Q.38.**Explain the aromatic, antiaromatic and non-aromatic with example.****Aromatic compounds :**

Aromatic compounds are cyclic, planar, fully conjugated compounds having $(4n + 2)$ π -electrons ($n = 0, 1, 2, \dots$) in accordance with *Hückel's rule*. They are *extra stable* due to *delocalisation* of π -electrons around the ring.

Hückel's rule (for aromaticity) :
A cyclic, planar, conjugated compound with $(4n + 2)$ π -electrons is aromatic.

Examples :

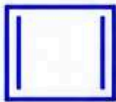
Benzene (6 π -electrons)	Cyclopentadienyl anion (6 π -electrons)	Naphthalene (10 π -electrons)
		
Benzene	Cyclopentadienyl anion	Naphthalene

Antiaromatic compounds :

Antiaromatic compounds are cyclic, planar, fully conjugated compounds having $4n$ π -electrons ($n = 1, 2, 3, \dots$). They are *unusually unstable* due to delocalisation of π -electrons, which leads to *destabilisation* of the ring.

A cyclic, planar, conjugated compound with $4n$ π -electrons is antiaromatic.

Examples :

Cyclobutadiene (4 π -electrons)	Cyclopentadienyl cation (4 π -electrons)	Cycloheptatrienyl anion (8 π -electrons)
		
Cyclobutadiene	Cyclopentadienyl cation	Cycloheptatrienyl anion

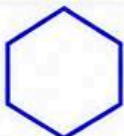
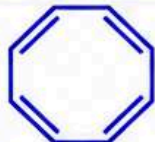
Non-aromatic compounds :

Non-aromatic compounds *do not satisfy* the conditions of aromaticity. They may be *non-planar* or *not fully conjugated*, or may not have the required number of π -electrons. Such compounds *do not* show the special stability of aromatic compounds.

Conditions for aromaticity :

1. Cyclic
2. Planar
3. Fully conjugated
4. $(4n + 2)$ π -electrons

Examples :

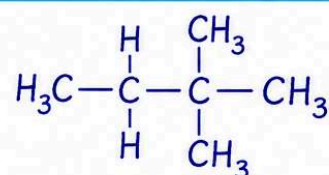
Cyclohexane (not fully conjugated)	Cyclooctatetraene (non-planar)	1,3-Butadiene (acyclic)
		$\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$
Cyclohexane	Cyclooctatetraene	1,3-Butadiene

Q.39.

Which would have a higher boiling point and why?



or



2,2-Dimethylpropane
(neopentane)

Answer :

- n-Pentane ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$) has a **higher** boiling point than 2,2-dimethylpropane (neopentane).
- Boiling point depends mainly on the **strength of intermolecular forces** (London dispersion forces).
- n-Pentane is a **straight-chain (unbranched)** molecule, so it has a **larger surface area** and **closer contact** between molecules. This leads to **stronger London dispersion forces** and therefore a **higher boiling point**.
- 2,2-Dimethylpropane (neopentane) is a **highly branched** molecule, which has a **more compact shape** and **smaller surface area**. Therefore, the intermolecular forces are **weaker**, resulting in a **lower boiling point**.

Conclusion :

n-Pentane has a **higher** boiling point because it has a **larger surface area** and **stronger London dispersion forces** compared to the more compact 2,2-dimethylpropane.

Q.40.

How will you show that ortho-cresol is less acidic than phenol?

Answer :

The acidity of phenolic compounds depends on the *stability* of their *conjugate base* (phenoxide ion). A compound is more acidic if its conjugate base is *more stable*.

The structures of phenol and ortho-cresol are :

Phenol	Ortho-cresol (2-methylphenol)
 Phenol	 Ortho-cresol

- In phenol, the phenoxide ion formed after loss of a proton from the $-OH$ group is *stabilised by resonance* over the aromatic ring, which makes phenol *more acidic*.
- In ortho-cresol, the presence of a methyl group ($-CH_3$) at the ortho position exerts a *+I effect* (electron donating effect). This increases the electron density on the ring and *destabilises* the phenoxide ion, making it *less stable*.
- Since the conjugate base of ortho-cresol is *less stable* than that of phenol, ortho-cresol is *less acidic* than phenol.

Conclusion :

Ortho-cresol is *less acidic* than phenol because the electron donating (*+I*) effect of the methyl group *decreases* the *stability* of its phenoxide ion, whereas the phenoxide ion of phenol is *more stable* due to resonance.

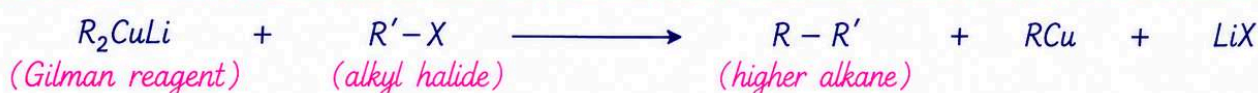
Q.41.

Explain Corey-House synthesis.

Introduction :

Corey-House synthesis is a method for the formation of *higher alkanes* by coupling an *organocuprate* (*Gilman reagent*) with an *alkyl halide*. It was developed by Elias J. Corey and Howard E. House.

General reaction :



Mechanism :

The reaction proceeds through *nucleophilic substitution*. The alkyl group from the attacks the carbon atom of the alkyl halide, leading to the formation of a *new C-C bond*.

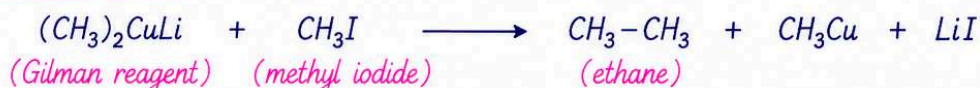
Step 1 : Formation of organocuprate (Gilman reagent)



Step 2 : Coupling with alkyl halide



Example :



Key features :

- Used for the synthesis of *symmetrical* and *unsymmetrical* *higher alkanes*.
- The reaction gives *good yields*.
- The alkyl halide can be *primary* or *secondary* (tertiary halides do not give good results).
- It is a useful method for *C-C bond formation*.

Explain the Acidity of terminal alkynes.

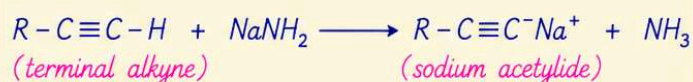
Introduction :

Terminal alkynes ($R-C\equiv C-H$) are **weakly acidic**. They can lose the terminal hydrogen to form an **acetylide ion** ($R-C\equiv C^-$). Their acidity is higher than that of alkenes and alkanes due to the involvement of an **sp -hybridised carbon**.

Reason for acidity :

- 1 High s-character :
The acidic hydrogen in a terminal alkyne is attached to an sp -hybridised carbon (50% s -character), which is more electronegative than sp^2 (33% s -character) or sp^3 (25% s -character) carbon. The greater s -character holds the electron pair closer to the nucleus, stabilising the negative charge of the conjugate base.
- 2 Stable conjugate base :
The conjugate base (acetylide ion) $R-C\equiv C^-$ is more stable due to the high s -character of the sp carbon.
- 3 Comparison with alkenes and alkanes :
In alkenes (sp^2) and alkanes (sp^3), the conjugate bases are much less stable, so they are far less acidic.
- 4 Resonance is not involved :
The acidity is mainly due to the hybridisation effect, not resonance.

Formation of acetylide ion :



Comparison of acidity (approximate pK_a values) :

Compound	Structure	pK_a (approx.)
Alkane	$R-CH_3$ (sp^3)	~ 50
Alkene	$R-CH=CH_2$ (sp^2)	~ 44
Terminal alkyne	$R-C\equiv C-H$ (sp)	~ 25

Example :



Conclusion :

Conclusion : Terminal alkynes are acidic because the terminal hydrogen is bonded to an *sp*-hybridised carbon with 50% *s*-character, which *stabilises* the conjugate base (acetylide ion). Therefore, terminal alkynes are *more acidic* than alkenes and alkanes.