UNIT-III

Alkyl halides :-

→ Alkyl halides also called haloalkanes or halogenoalkanes are chemical compounds that are often derived from alkanes that contain one or more halogens.

→ Alkyl halides or haloalkanes are formed by the replacement of hydrogen atoms in an aliphatic hydrocarbon by halogen atoms (Fluorine, Chlorin, bromine or Iodine).

Example:-

CH_3-CH_2-I (Iodoethane)

$CH_3-\underset{Cl}{CH}-CH_3$ (2-Chloropropane)

$CH_3-\underset{CH_3}{CH}-CH_2-Br$ (1-bromo-2methylpropane)

Classification :-

1. Classification based on the number of halogen atoms.

They These may be classified as mono, di, or polyhalogen compounds depending on whether they contain one, two or more halogen atoms in their structure.

Example:-

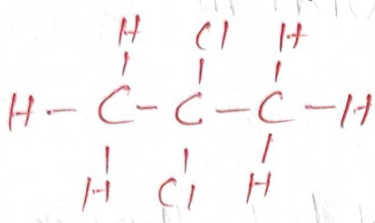
C_2H_5X (Monohalo alkane)

$\begin{matrix} CH_2X \\ | \\ CH_2X \end{matrix}$ (Dihalo alkane)

$\begin{matrix} CH_2X \\ | \\ CHX \\ | \\ CH_2X \end{matrix}$ (Trihalo alkane)

(ii) Gem-dihalides: The two halogen atoms are attached to the same Carbon atom in gem-dihalides.

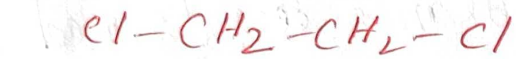
Example :-



(2,2-dichloropropane)

(iii) Vic-dihalides :-

In these Compounds, the two halogen atoms are attached to adjacent Carbon atoms.



(1,2 dichloroethane)

★ SN_1 REACTION :-

- The SN_1 reaction is a nucleophilic Substitution reaction where the rate-determining step is unimolecular.
- SN_1 reaction mechnism follows a step by-step process where in first the Carbocation is attacked by the nucleophile.
- Finally, the deprotonation of the protonated nucleophile takes places to give the required product.
- The reaction involves the formation of a Carbocation intermediate.
- It is generally seen in the reactions of tertiary or secondary alkyl halide with Secondary or tertiary alcohols under Strongly acidic or strongly Conditions.

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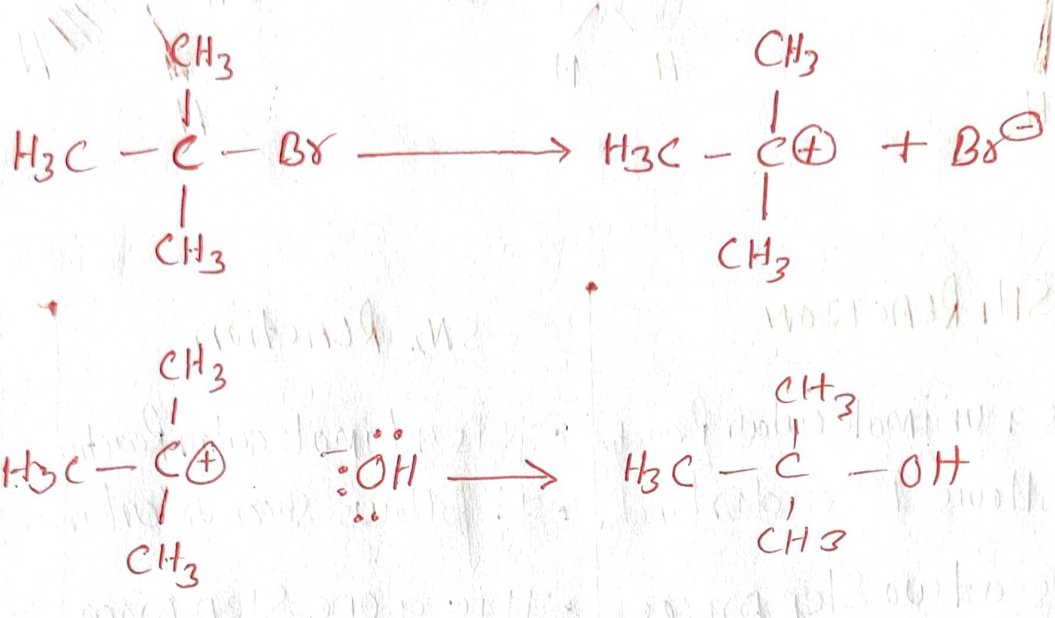
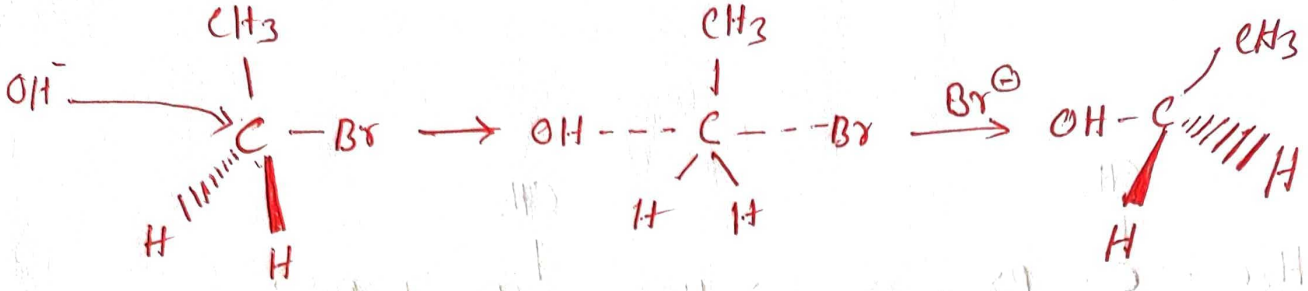


(ii) SN_2 REACTION :-

- SN_2 Stand for bimolecular Nucleophilic Substitution Reaction.
- The reaction follows Second order of kinetics.
- The Reactivity order $1^0 > 2^0 > 3^0$.
- It is one step process.
- Formation of Transition State take places.

Mechnism :-

- In SN_2 reaction the nucleophile attaks on Carbon atom of Alkyl halide from backside which results in the formation of transition state & Ultimately give product of opposite / invcoted Configuration to that of initial Alkyl halide.



SN_1 REACTION	SN_2 REACTION
• It is a unimolecular Reaction	• It is a bimolecular Reaction
• It follows 1st order kinetic	• It follows second order kinetic
• It is a two Step process	• It is a one Step process
• Reactivity order: 3°>2°>1°	• Reactivity order: 1°>2°>3°

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☆ Factor affecting SN_1 & SN_2 Reaction :-

(i) Nature of Substrat :-

- As a result, SN_2 Mechnism is favored in primary halides and least favored in tertiary halides.
- Reactivity order of alkyl halide towards SN_2 Mechnism

$$3^\circ < 2^\circ < 1^\circ < H_3C-X$$

(ii) Nucleophilicity of the reagent :-

- SN_2 Mechnism: A more powerful nucleophile attaks the substrate faster and favours the SN_2 Mechnism.
- SN_1 Mechnism: The rate of the SN_1 Mechnism is independent of the nature of nucleophile as nucleophile does not react in the slow step of SN_1.

(iii) Solvent polarity :-

- SN_2 Mechnism: polar protic solvents usually decrease the rate of an SN_2 reaction.
- In the rate-determining step of the SN_2 Mechnism the substrate, as well a nucleophile. It involved.
- Thus SN_1, reaction proceeds more rapidly in polar protic solvent than in approtic solvent.

✱ Structure and uses of different Compounds :-

① ETHYL CHLORIDE (C_2H_5I) :-

Structure

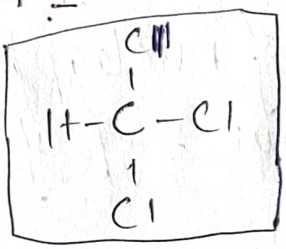
$$CH_3 - CH_2 - Cl$$

Uses :-

1. Use as a refrigerant.
2. Used as chemical promoter
3. Used to prepare tetra ethyl lead.
4. used for industrial purpose.
5. Used as an anesthetics.
6. Used as a inhalant drug,
7. Used in dentistry

② CHLOROFORM :-

Structure :-



Uses :-

1. Use as reagent
2. Used for the preparation of teflon.
3. As a Industrial Solvent.
4. Use as general anesthetic.

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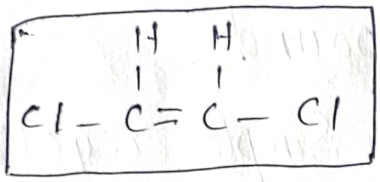
③ TRICHLORO ETHYLENE :-

Structure :-

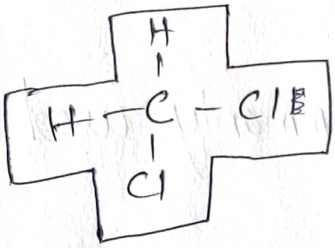


Uses :-

1. Use an anaesthetic
2. Use as Solvent.
3. Dry Cleaning Solvent.

④ DICHLORO METHANE :-

Structure :-

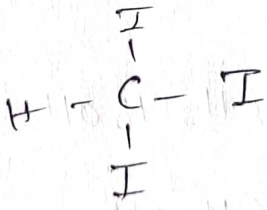


Uses :-

1. Used as ~~Solvent~~ plastic welding adhesive
2. ~~As an ana~~
2. used in garment printing industry.

⑤ IODOFORM :-

Structure :-



Uses :-

1. Used for poisoning
2. used as disinfectant
2. For removing hair.

★ Alcohols:-

- Alchols are organic Compounds that have one or more hydroxy (-OH) groups bonded to the Carbon atoms in aliphatic Compounds.
- The General formula for a Simple acyclic alchohol is $C_nH_{2n+1}OH$, where n = 1,2,3 etc.
- Alcohol Can be viewed as organic analogues of water in which one hydrogen atom is replaced by an alkyl groups.
- In alcohols, -OH group is attached to sp^3 hybridised Carbon.
- The Simplest and most Commonly used alcohols are Methanol and Ethanol.

CH_3OH	CH_3CH_2-OH
Methanol	Ethanol

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#Classification:-

① Monohydric Alcohols: CH_3CH_2OH, $CH_3CH_2CH_2OH$

② Dihydric Alcohols:

$$\begin{array}{l} CH_2OH \\ | \\ CH_2OH \end{array}$$

③ Trihydric Alcohols:-

$$\begin{array}{l} CH_2OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array}$$

NOMENCLATURE :-

- According to the IUPAC System of nomenclature, alcohols are called alkanols.
- They are named as the derivatives of the corresponding alkenes in which the -e of the alkane is replaced by -ol.

☆ Qualitative test :-

Distinction between primary, Secondary and Tertiary Alcohols.

① oxidation :-

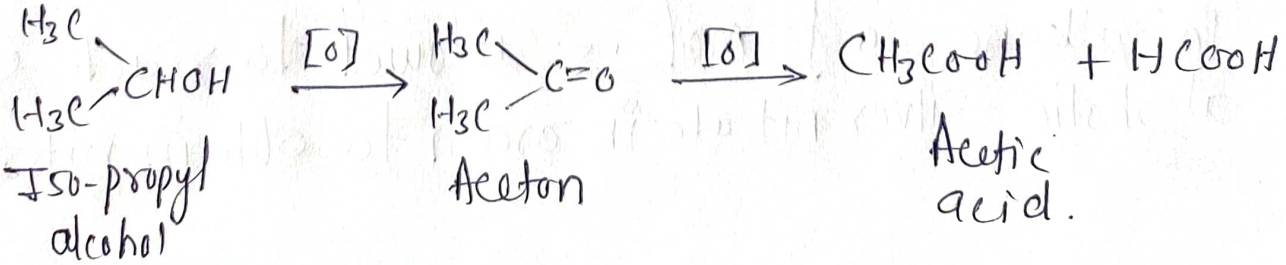
oxidation of alcohols involves the formation of a Carbon-oxygen double bond with the cleavage of an O-H and C-H bond.

- Primary alcohol on oxidation gives aldehyde and on further oxidation yield Carboxylic Acid.

$$CH_3CH_2OH \xrightarrow{[O]} CH_3CHO \xrightarrow{[O]} CH_3COOH$$

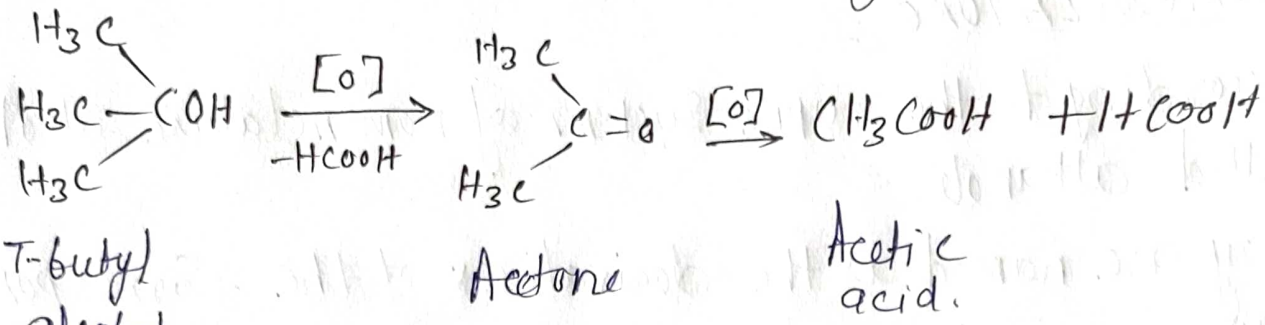
Ethanol — Acetaldehyde — Acetic acid

- Secondary alcohol on oxidation gives ketone which upon further oxidation yield Carboxylic acid.



Iso-propyl alcohol — Aceton — Acetic acid.

- Tertiary alcohol on oxidation gives ketone which upon further oxidation yield Caboxylic acid.



T-butyl alcohol — Acetone — Acetic acid.

(2) Dehydrogenation of alcohol by the action of hot reduce Copper :-

All three Class of alcohol behave differently with hot reduce Copper at 570k.

Actaldehyde.

(3) Victor Mayer Method :-

Victor Meyer's Test is one of the prominent test to distinguish b/w primary, Secondry and tertiary alcohols.

- Different Colour are observed for different alcohols.
- The alcohol is treated with iodine in presence of red Phosphorus to obtain iodoalkane.
- Iodoalkane so formed is allowed to react with alcoholic Silver nitrate in order to obtain nitroalkane.

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- The nitroalkane is treated with nitrous acid (Mixture of $NaNO_2$ and HCl and the resulting Solution is made alkaline by the addition of Caustic Soda.
- The Colour of the resulting Solution is observed in which following observation are made.
- The Primary alcohol gives blood red Colour.
- The Secondary alcohol gives the blue Colour
- And the tertiary alcohol does not produce any Colour.

☆ Structure and uses of different alcohols :-

① ETHYL ALCOHOL :-

Structure :- CH_3-CH_2-OH

uses :-

1. use as antiseptic
2. Manufacturing of alcoholic beverage
3. For preservative for biological Specimens.

② METHYL ALCOHOL :-

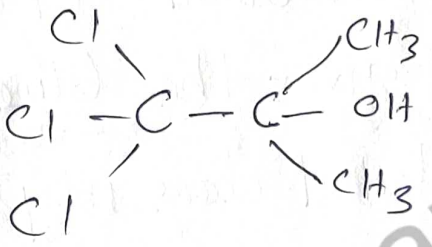
Structure :- $H_3C - OH$

Uses :-

1. In the production of Synthesis gas.
2. Raw Material for Synthesis of formaldehyde.
3. use as fuel for vehicls.

③ CHLOROBUTANOL :-

Structure :-



Uses :-

1. used as antibacterial agent.
2. used as preservatives in eye drop, Injection, Creams and Mouthwash.
3. uses as Sedative and hypnotics.

④ CETOSTERYL ALCOHOL :-

Structure :- $C_{74} H_{72} O_2$

Uses :-

1. preparation of emulsifying wax.
2. opacifying agent, and foam boosting Surfactant.

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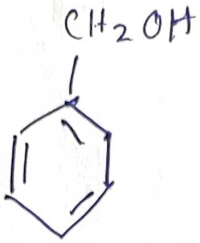
⑤ **Benzyl Alcohol :-**

Structure :-

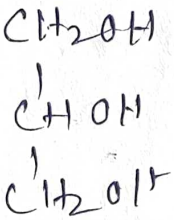


Uses :-

1. used as antiseptic
2. used to treat asthma and whooping Cough.

⑥ **Glycerol :-**

Structure

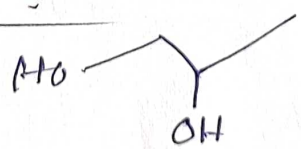


Uses :-

1. used as humectants, Solvent and Sweetner.
2. used in Soaps, hand lotion, toothpaste and bakery product.

⑦ **Propylene Glycol :-**

Structure :-



Use :-

1. used as drug Solubiliser in topical, oral and injection.
2. pharmaceutical additives.
3. used as a antifreez agent.