

Unit = III

ALKYL HALIDES

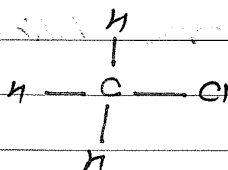
I Alkyl halides are compounds in which halogen atom attached to carbon.

II They have General formula $R-X$

where R = Alkyl group

X = Cl, Br, I, F

Example :-



methyl chloride.

Methods of Preparation

1. Halogenation of alkanes

Alkane reacts with Cl_2 in presence of UV-light or high temp. to give alkyl halides, along with polyhalogen derivatives.



This method can not be used - bec separation difficulty.

2 Addition of Halogen Acids to Alkenes.

Halogen Acid - HCl / HBr / HI Add to alkenes.
yield alkyl halides.

General Reaction



Example



3. Action of Phosphorus Halides on Alcohols.

Alcohol reacts with phosphorus halides (PX_5 or PX_3)
to form alkyl halides.

General Reaction



Example



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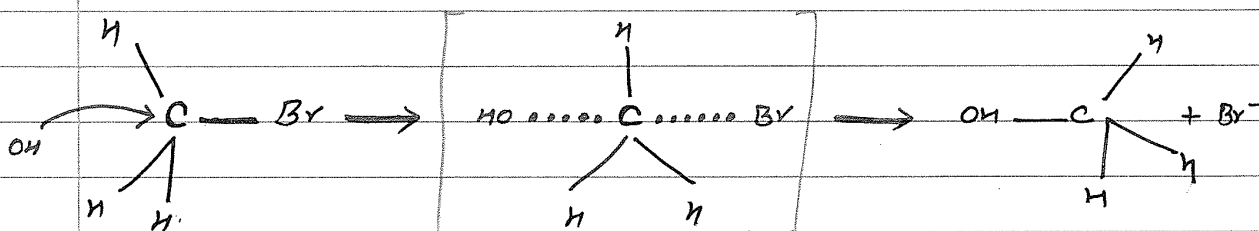
S_N-2 Reaction

S_N-2 stand for Bimolecular nucleophilic substitution.

In this mechanism :- The attack of Nucleophile and the Ejection of the halide ion take place simultaneously.

The reactants on their way to products pass through a transition state, where :- the C-OH bond is half-formed and the C-X bond is half.

Consider the Example of the hydrolysis of Methyl bromide by aqueous NaOH.



Methyl bromide

Transition state

Methyl alcohol

S_N-1 Reaction.

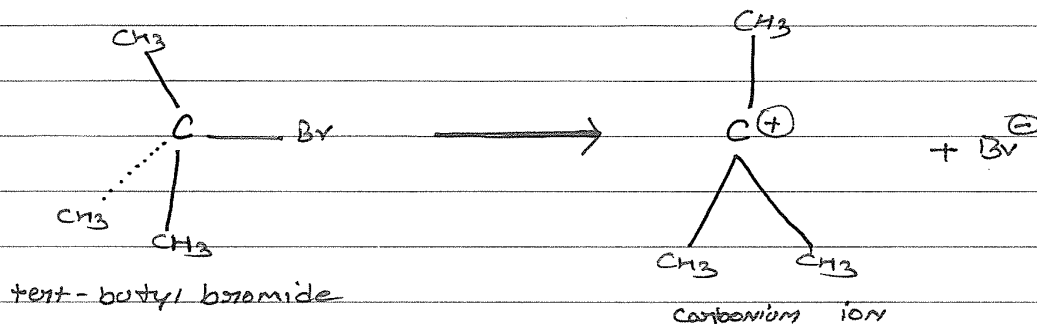
S_N-1 stands for Unimolecular nucleophilic substitution.

The Mechanism Involves two steps :-

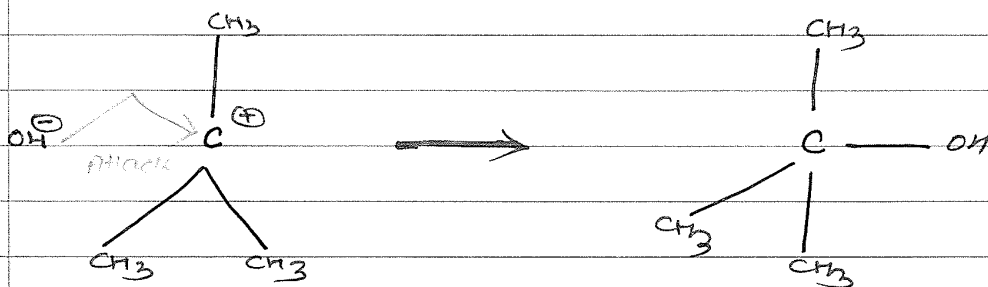
Consider the hydrolysis of tert-butyl bromide with $Aq-NaOH$.

Step-I a) The alkyl halide ionizes to give a planar carbocation ion.

b) The carbocation ion is planar because the central positively charged carbon atom is sp^2 hybridized.



Step-II The nucleophile can attack the planar carbocation ion from either side to give the product.



tert-butyl Alcohol

___/___/___

Difference b/w S_N1 and S_N2 Reaction.

S_N1 Reaction

S_N2 Reaction.

Two step mechanism

One step mechanism

Rate depends only on
conc. of Alkyl halide

Rate depends on conc. of
Alkyl halide + Nucleophile.

Is Unimolecular

Is Bimolecular

Rate Depends on stn of halide
 $3^\circ > 2^\circ > 1^\circ > CH_3X$

Rate Depends on stn of halide
 $CH_3X > 1^\circ > 2^\circ > 3^\circ$

Reaction is favoured by
polar solvents

Reaction is favoured by
non polar solvents

Reaction can occur with
weak base

Reaction can occur
with strong base.

Factors Affecting S_N1 and S_N2 Reactions.

1. The Electrophile

when the leaving group is attached to the methyl group on primary carbon an S_N2 mechanism is favored.

when the leaving group is attached to a tertiary, allylic, benzylic carbon, a carbocation intermediate will be relatively stable and thus an S_N1 mechanism is favored.

2. The Nucleophile

powerful nucleophiles especially those with negative charge favor the S_N2 mechanism.

weaker nucleophiles such as water or alcohols favor the S_N1 mechanism.

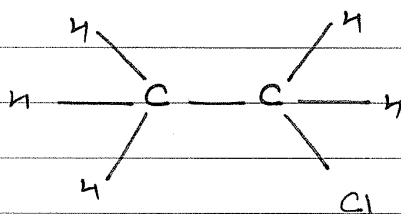
3. The Solvent

polar aprotic solvents favor the S_N2 mechanism by enhancing the reactivity of the nucleophile.

polar protic solvents favor the S_N1 mechanism by stabilizing the carbocation intermediate.

STRUCTURE AND USES

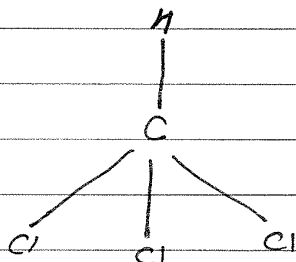
1. Ethyl Chloride (C_2H_5Cl)



USES

- It is used in the synthesis of Ethyl Cellulose.
- It is used as a solvent, refrigerant, topical anaesthetic.
- In industry used for manufacturing of dyes, chemicals.

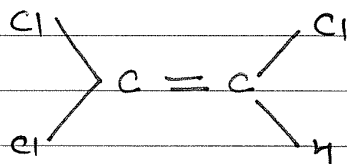
2. Chloroform ($CHCl_3$)



USES

- It is used as a solvent for fats, alkaloids, and other substances.
- It is mainly used in the production of Freon refrigerant.
- It is used as a general anaesthetic.

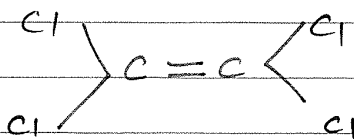
3. Tri-chloroethylene (C_2HCl_3)



Uses

- Used as a solvent
- Used as a type-written correction fluid
- Used as a chemical Intermediate.

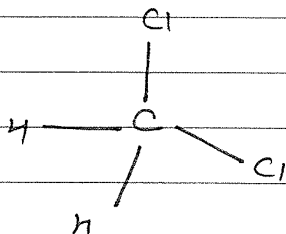
4. Tetrachloroethylene (C_2Cl_4)



Uses

- Used for dry cleaning & textile processing.
- Used as chemical Intermediate.
- Used as rubber coating, solvent soaps, lubricant.
- Used as heat transfer medium in copying machines

5. Dichloromethane (CH_2Cl_2)



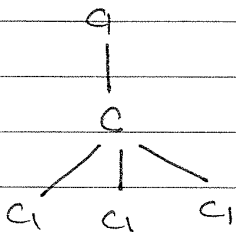
Uses

used as paint removers

used as insect sprays

used as a solvent for extraction of caffeine, coffee,

6. Tetrachloromethane (CCl_4)



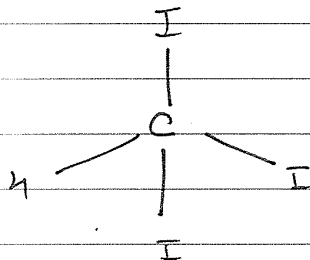
Uses

a. used as a solvent for oils, rubber, waxes, resins.

b. used as dry cleaning agent.

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Iodoform (CHI_3)

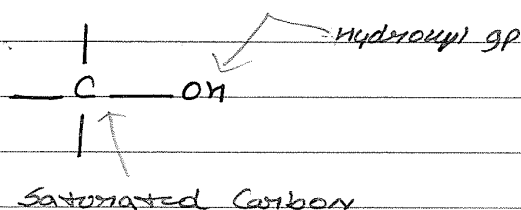


Uses.

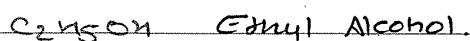
a. used as Antiseptic

ALCOHOLS

ALCOHOLS are a compounds in which hydroxyl (-OH) group attached to saturated Carbon atom.



Example

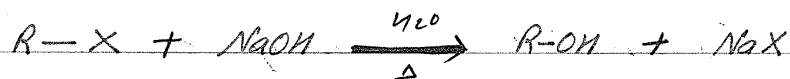


Methods of Preparation

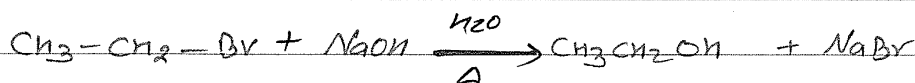
1. Hydrolysis of alkyl Halides.

Alkyl halide reacts with Aq Sodium hydroxide to form Alcohol

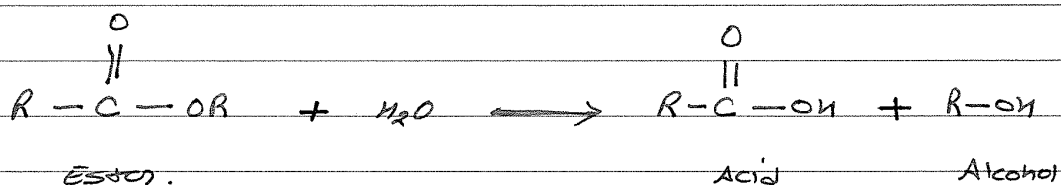
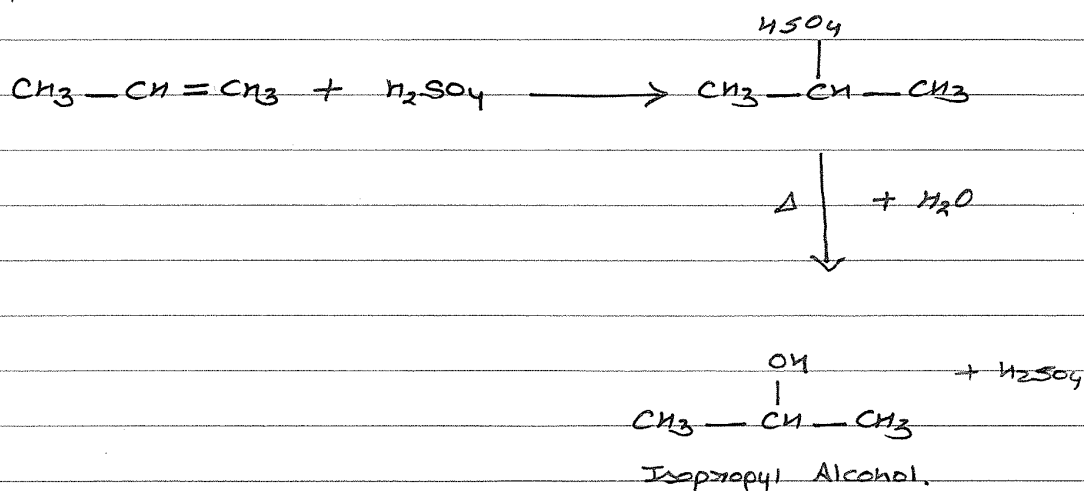
Gr- Reaction



Example



Alkenes reacts with sulfuric acid to produce alkyl hydrogen sulfates.,
alkyl hydrogen sulfates hydrolysis give Alcohols.

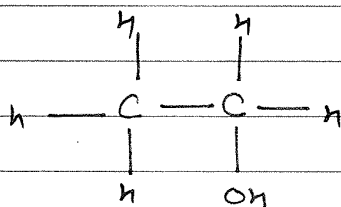


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QUALITATIVE TEST of ALCOHOLS

STRUCTURE & USES

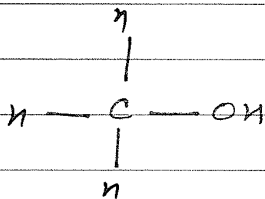
1. Ethyl Alcohol C_2H_6O



Uses

- Industrial Solvent
- Major constituents of medicines
- found in different Alcoholic Beverages
- used as pain reliever.

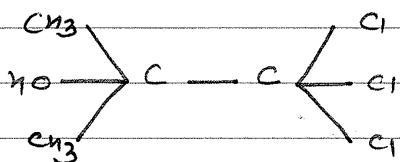
2. Methyl Alcohol (CH_3OH)



Uses

- used as fuel, solvent,
- used for many syntheses,
- used as Industrial Solvent
- used for manufacturing of photographic films, textile soaps, wood stain.

3. Chlorobutanol ($C_4H_7Cl_3O$)



Uses

highly Effective preservative
used as cosmetic industry
used as Antibacterial & Antifungal Agent

4. Cetyl Alcohol ($C_{18}H_{38}O \cdot C_{16}H_{34}O$)

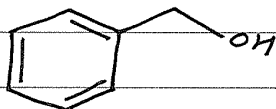


Uses

used as Cosmetic Agent.
" foaming Agent
" Emollient.

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Benzyl Alcohol ($C_6H_5CH_2OH$)



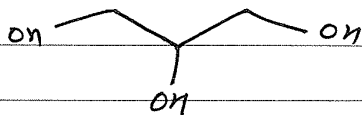
Uses

Used as preservatives

Used in epoxy paints, gelatin, casein, fibers, inks.

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Glycerol (C_3H_8O)



Uses

a Basic Ingredient of gum & Resins

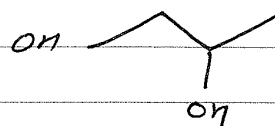
b used as Softening Agent.

c used as skin lotion, mouthwash, etc.

d used freezing of living tissues.

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Propylene Glycol ($C_3H_8O_2$)



Uses - Drug Solubiliser

stabiliser for Vit

moisturiser in cosmetics.