

**UNIVERSITY SOLVED QUESTION
WITH ANSWER**

Year : 2018-19

Subject : Pharmaceutical Organic
: Chemistry-I

Subject Code : 23PBP203

Subject In-Charge : Mr. Biswajit Biswal



Registration No :

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Total Number of Pages : 01

B.Pharm
BP202T

2nd Semester Regular / Back Examination 2018-19

PHARMACEUTICAL ORGANIC CHEMISTRY I

BRANCH : B.Pharm

Time : 3 Hours

Max Marks : 75

Q.CODE : F196

Answer Question No.1 (Part-A) and 02 (Part-B) which are compulsory and any TWO from Part-C.

The figures in the right hand margin indicate marks.

Part- A

Q1 Objective Answer Type Questions (Answer All) (2 x 10)

- What is Tollens reagent ?
- What is Rectified & Methylated Sprit ?
- What is Iodoform Reaction ?
- Write the equation involved in Carbylamines reactions?
- What is the difference Between Gem-Vic Dihalide?
- What is Rosendmund Reduction ?
- Why chloro acetic acid is more acidic than acetic acid?
- Write the structure & Use of Hexamine?
- What is saytzeff rule with suitable examples?
- What is Hinesburg test to distinguish between Primary, Secondary and Tertiary Aliphatic Amines?

Part- B

Q2 Focused-Short Answer Type Questions- (Answer Any Seven) (5 x 7)

- Discuss Sp³ hybridizations with suitable examples.
- Explain Cannizzaro reaction reaction.
- How you differentiate 1^o, 2^o & 3^o Alcohol.
- Explain Diel-Alder Reaction with suitable example.
- Discuss the mechanism of E1 Reaction with suitable example.
- Explain Markovnikove rule with suitable Example.
- Write the free-radical substitution reaction of methane.
- Write the structure and use of following compounds: Acetyl salicylic acid , Paraldehyde, Propylene glycol, Vanilin & Citric acid.
- Explain Aldol condensation Reaction.

Part-C

Q3 Long Answer Type Questions (Answer Any Two) (10)

Outline the general methods of preparations and Chemical reactions of aldehyde.

Q4 (10) Discuss SN₁ and SN₂ reactions, Explain Factors affecting SN₁ and SN₂ reactions.

Q5 (10) Write a note on Structural Isomerism in organic with suitable example. Discuss the common IUPAC system of nomenclature of Alcohol & Carboxylic Acid.

Q6 (10) Describe the Five general methods of preparations and Chemical reactions of alkenes.

Q1a) what is Tollen's reagent?

A) Tollen's reagent is a chemical solution commonly used to test for the presence of aldehydes.

- The Tollen's reagent reduces the silver ions to metallic silver (Ag) which form a shiny mirror coating on the inside of the test tube.

- Tollen's reagent does not react with ketones making it a useful test for distinguish between aldehyde and ketones.

b) what is Rectified and methylated spirit?

A) Rectified spirit and methylated spirit are two types of alcohol with specific composition and purposes.

Rectified spirit:

Definition: A highly concentrated ethanol, typically purified through repeated distillation.

Composition: contains about 95-96% ethanol by volume with the rest being water.

Methylated spirit:

Definition: Ethanol that has been denatured by adding chemicals. Usually methanol.

Composition: contains ethanol (90-95%) mixed with methanol (around 5-10%) or other denaturants like pyridone acetone or dyes.

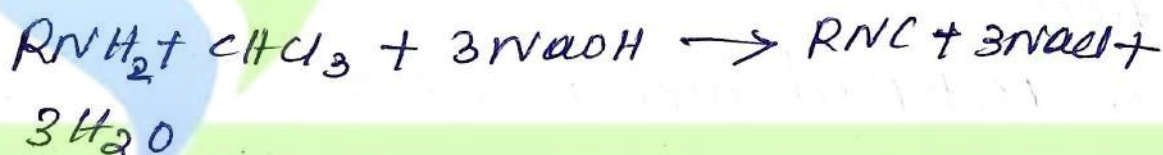
c) what is iodoform reaction?

A) The iodoform reaction is a chemical test used to detect the presence of methyl ketones.

- It is often used to distinguish certain alcohols and ketones in organic chemistry.

d) write the equation involved in carbyl amine reaction?

A) The reaction \rightarrow



where

RNH_2 is a primary amine

$CHCl_3$ is chloroform

$NaOH$ is sodium hydroxide

RNC is the isocyanide (carbylamine)

The reaction produces a characteristic foul smelling carbylamine (isocyanide) which serves as a positive test for amines.

e) what is the difference between gem - vic dihalides?

A) The main difference between geminal dihalide and vicinal dihalide is that

geminal dihalide have both halide group attached to the same carbon atom of the compound.

- where as the vicinal dihalides have two halide groups which are attached to two adjacent carbon atoms in the same compound.

Q) Example of geminal halide - 1,1-dibromomethane
Example of vicinal halide - 1,2-dibromomethane.

Q) What is Rosenmund Reaction?

A) The reaction was discovered by Karl Wilhelm Rosenmund in 1918.

- The Rosenmund reaction is a hydrogenation process that convert acyl chlorides into aldehydes.

- The general reaction is



- The reaction is particularly useful in organic synthesis.

Q) Why chloroacetic acid is more acidic than acetic acid?

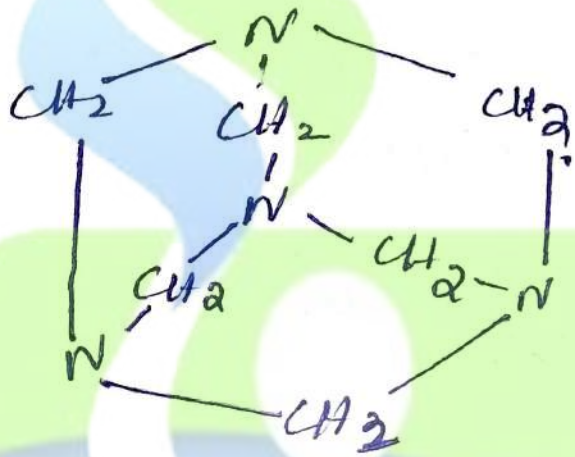
A) Chloroacetic acid is more acidic because the chlorine atom in chloroacetic acid stabilize the conjugate base of chloro

acetic acid more effectively than the methyl group in acetic acid,

- Thus it is due to electron withdrawing affect of chlorine,

b) write the structure and use of hexamine?

A) Structure of hexamine:



uses

- It is used as urinary antiseptic
- It is used as disinfectant.
- It is used as absorbent for absorbing poisonous gases.
- It is used adhesives, coating and sealing compounds.

Q) what is saytzeff rule with suitable example?
A) saytzeff's rules state that in an elimination reaction the alkene with the most alkyl group attached to the doubly bonded carbon atoms is the preferred product.

- This is because more substituted alkenes are more stable.

Example: when 2-bromobutane is dehydrohalogenated it produces 1-butene and 2-butene is the major product because it is more substituted and more stable.

Q) what is hinsberg test to distinguish between primary, secondary and tertiary aliphatic amines?

A) The hinsberg reaction is a chemical test for the detection of primary, secondary and tertiary amines.

- primary secondary and tertiary amine means they are distinguished by the number of carbon atoms bonded to nitrogen atom.

5 marks answer

Q1) Discuss sp^3 hybridization with suitable example?

A) All the carbon of alkanes shows sp^3 hybridization

- In sp^3 hybridization one s orbital combines with three p orbitals to form four equivalent sp^3 hybrid orbitals.

- Each sp^3 hybrid orbital shows 25% s orbital characteristics and 75% p orbital characteristics.

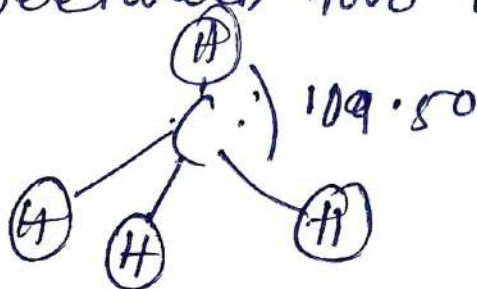
Ex: sp^3 hybridization of carbon in alkanes
ground state

Excited state

Hybridised state

- The carbon of alkanes shows tetrahedral arrangement

- The angle between two orbitals is 109.5°



- Paraffin
- It is nothing but simply the alkanes
 - It is made up two words - parum - little
 - they are relatively inert towards chemical reagent
- Affinis - Affinity

Use of paraffins

- paraffins are widely used as fuel component for diesel and tractor engines.
- It also used as fuel for jet and rocket.
- It also used as ingredient in many agricultural and insecticides.

b) Explain Cannizzaro reaction?

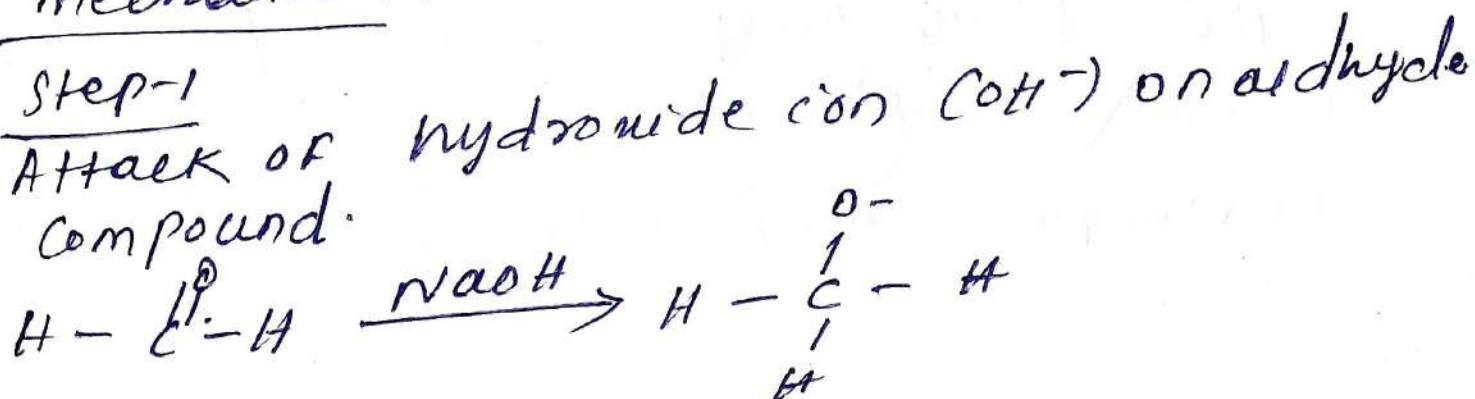
A) Cannizzaro reaction is a type of organic reaction in which reaction takes place between the aldehydes that do not contain α -hydrogen.

- Reaction takes place only in the presence of concentrated base.

Mechanism:

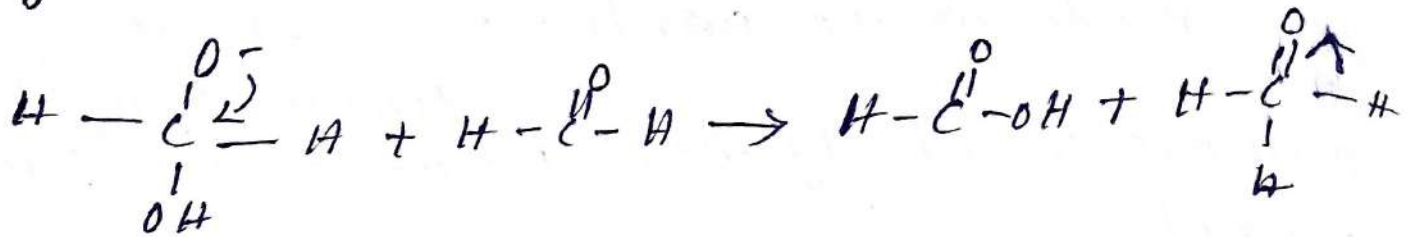
Step-1

Attack of compound.



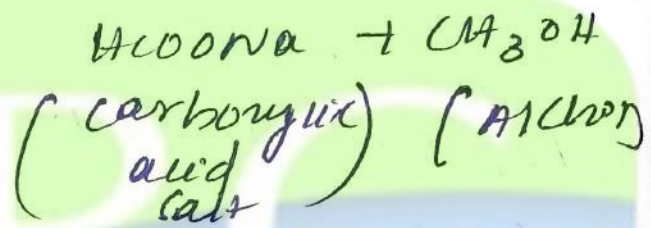
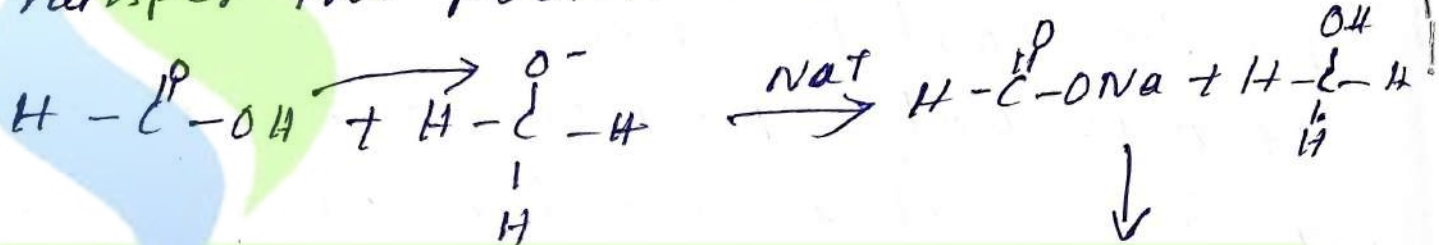
Step-2

hydride shift



Step-3

Transfer the proton and addition of Na⁺



(C) How you differentiate 1°, 2°, 3° alcohol?

A) To differentiate 1°, 2°, 3° alcohol is known as primary secondary and tertiary alcohol

Primary alcohol :- The carbon atom attached to the hydroxyl group is connected to only one other carbon atom.

- its example ethanol, $\text{CH}_3\text{CH}_2\text{OH}$

secondary alcohol \div The carbon atom attached to the hydroxyl group is connected to two or other carbon atoms.

Example \div isopropanol $\text{CH}_3\text{CH(OH)CH}_3$.

Tertiary alcohol \div The carbon atom attached to the hydroxyl group is connected to three other carbon atoms.

Example \div tert-butyl alcohol \div $\text{CH}_3\text{COH}\cdot\text{CH}_2\text{CH}_3$

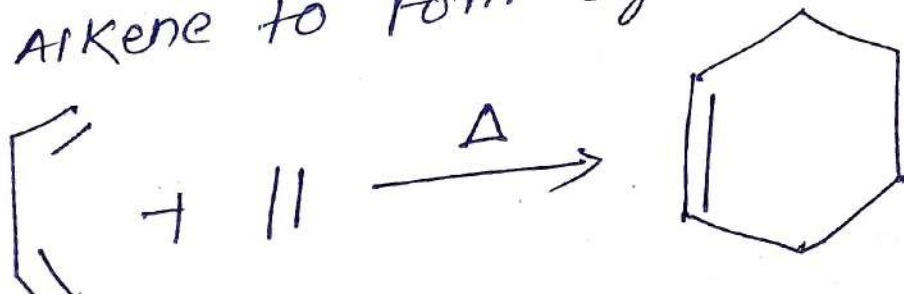
The key difference is the number of carbon directly bonded to the carbon with the -OH group.

1) Explains the Diels-Alder reaction with suitable example?

2) The reaction was given by Otto Paul Hermann Diels and Kurt Alder.

- They also awarded with Nobel prize in 1950 for the discovery.

The Diels-Alder reaction is an organic chemical reaction between a conjugated diene and an alkene to form cyclohexene.



mechanism of Diels Alder reaction

- Diels Alder reaction is a single step process.

- Electron from the dienophile attacks on carbon (C) 1 on the diene resulting in the formation of single bond between C₁ and C₆.

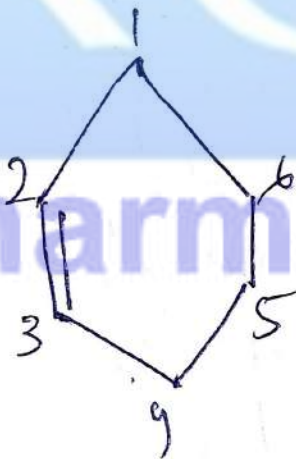
- Double bond between C₁ and C₂ re locates to between C₂ and C₃.

- Double bond between 3 and 4 broken and electrons from a single bond between 4 and 5 to form pi bond product.

- finally cyclohexene forms



Conjugate diene
dienophile



cyclohexene

1) Discuss the mechanism of E₁ reaction with suitable example?

1) E₁ reaction stands for unimolecular Elimination reaction.

- It is a two step process.

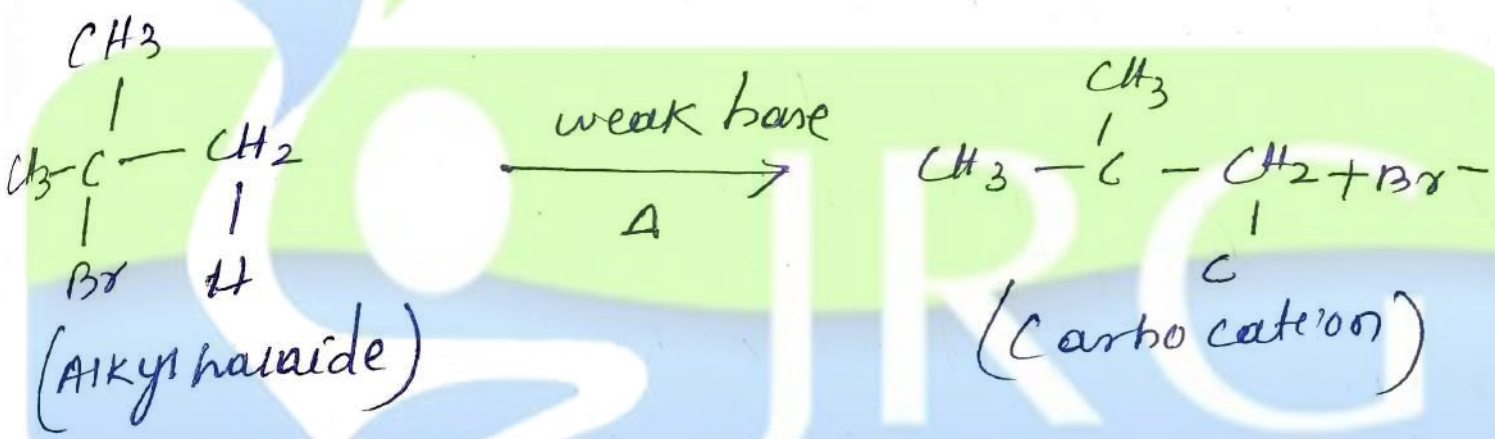
- The reaction follows first order kinetics

- weak base used in E₁ reaction

- The reaction proceeds at high temperature

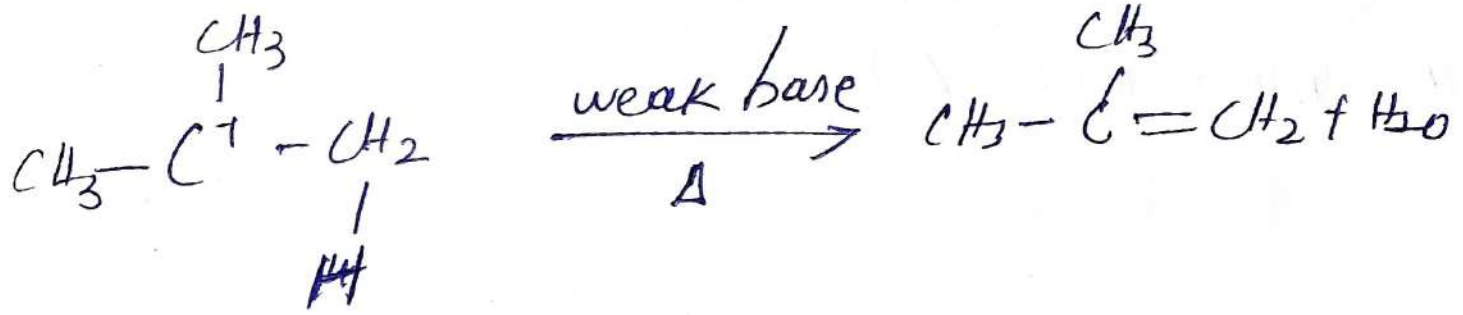
Step-1

formation of carbocation (rate determining step)



Step-II

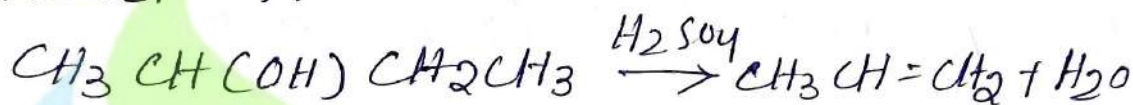
loss of proton from the carbon atom adjacent to the carbon containing positive charge.



The mechanism typically occur under condition where carbocation can be stabilized, such as with a polar solvent or when a good leaving group is present.

Example:

Reaction:

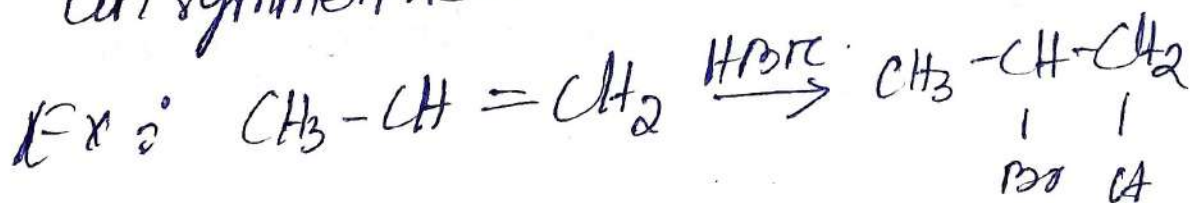


P) Explain markovnikov's rule with suitable example?

A) The rule or principle was given by Russian chemist markonikov.

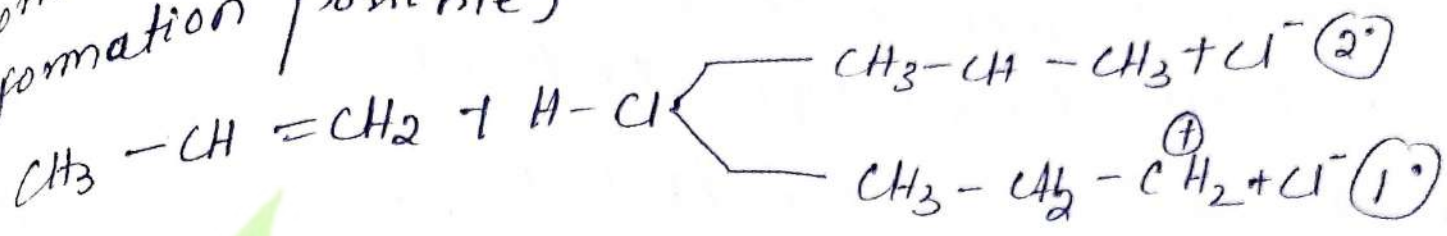
- According to markonikov's rule during the addition reactions of alkenes the hydrogen atom (H) is added to that carbon atom which has maximum number of hydrogen atom.

- The rule is basically given for unsymmetrical alkenes.

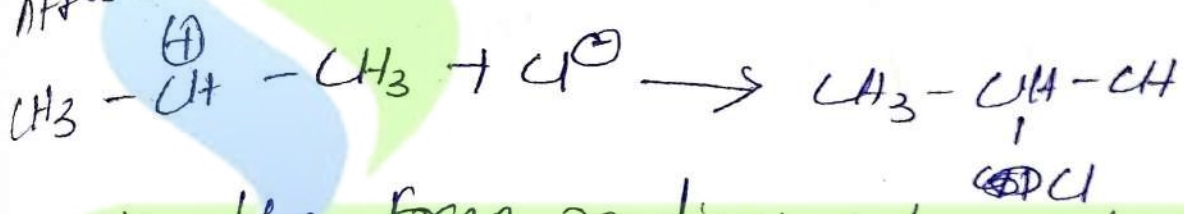


Mechanism:

Step-1
formation of carbocation (two carbocation formation possible)



Step-2
Attack of nucleophile to 2° carbocation



Q write the free radical substitution reaction methane?

A) A free radical substitution reaction involving methane is a type of chemical reaction.

- where a hydrogen atom in methane is replaced by a halogen atom (such as chlorine or bromine) under the influence of UV light or heat.

- This reaction proceeds through a chain mechanism involving the formation of free radicals, which are highly reactive atoms or molecule with unpaired atoms.

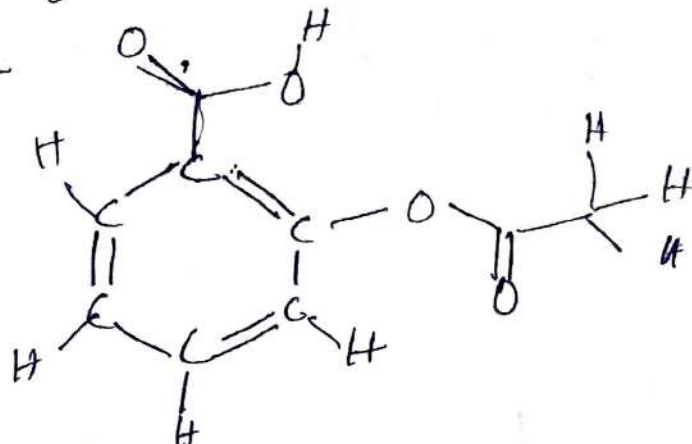
The general steps are

1. initiation \div The halogen molecule Cl_2 is broken into two halogen radicals by UV light or heat.
2. Propagation \div The halogen radicals reacts with methane replacing a hydrogen atom to form a methyl radical and a halogen containing a product.
3. Termination \div The free radicals combines to form stable molecules ending the chain reaction.

This process leads to formation of chloromethane and potentially further halogenated products.

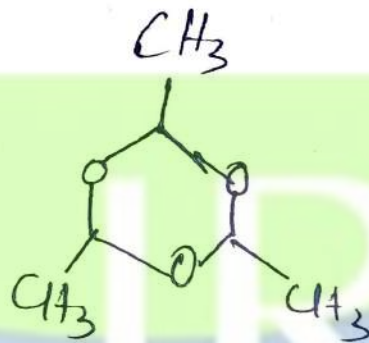
(b) write the structure and use of Acetylsalicylic acid, paracetamol, propylene glycol, vanillin and citric acid?

1) Acetylsalicylic acid :-
Structure



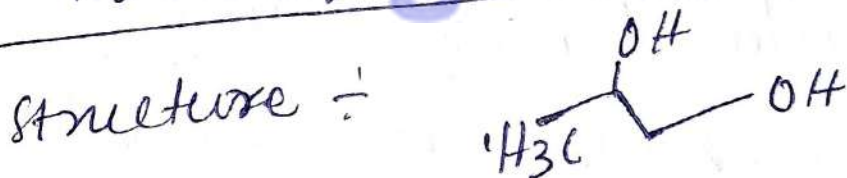
uses :- It is used in the regular tablet form. It is indicated to relieve pain.

paraldehyde :-
Structure



uses :- It is used to treat certain convulsion disorders.

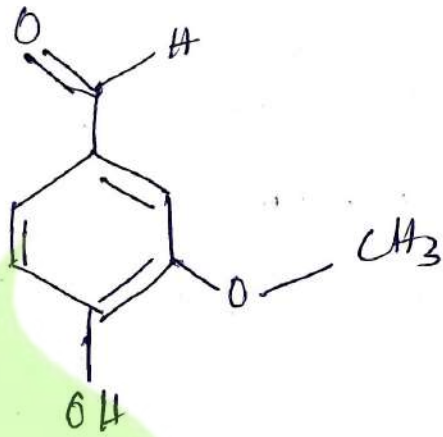
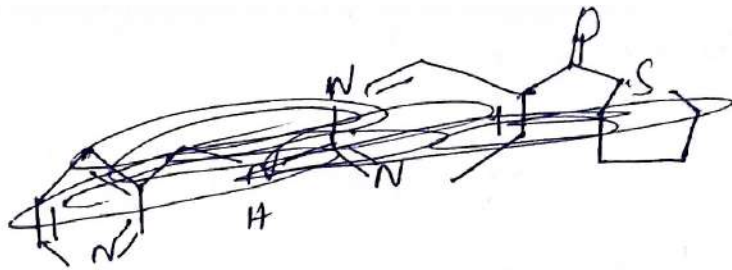
propylene glycol :-



use :- It is used in the chemical, food and pharmaceutical industries.

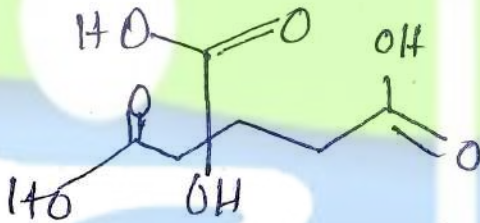
Vanillin
~~Vanillin~~

Structure →



uses :- It uses the pharmacological actions including anticancer, antidiabetic, antioncancer.

citric acid



uses :- used in food cosmetic and cleaning products

Q) Explain aldol Condensation reaction?
A) Aldehyde or ketones having at least α -hydrogen undergoes an organic reaction in presence of dilute base. to form β -hydroxyaldehyde or β -hydroxyketone known as aldol the reaction known as aldol reaction.

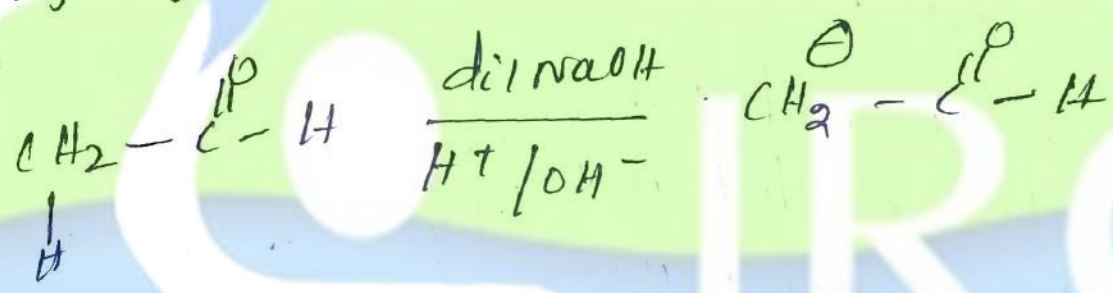
~~Mechanism~~
~~Step I~~

finally after the formation of Aldol by removing a water molecule a new product is known as Enol and the reaction is known as Aldol condensation

Mechanism

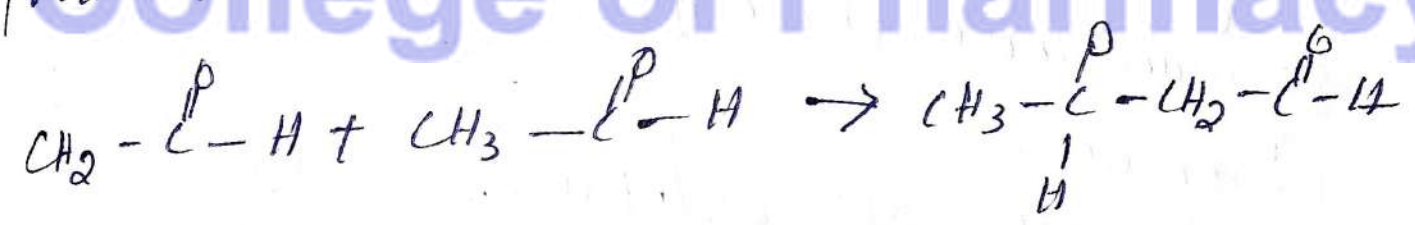
Step-1

Hydronide act as a base removes the acidic α -hydrogen from aldehyde.



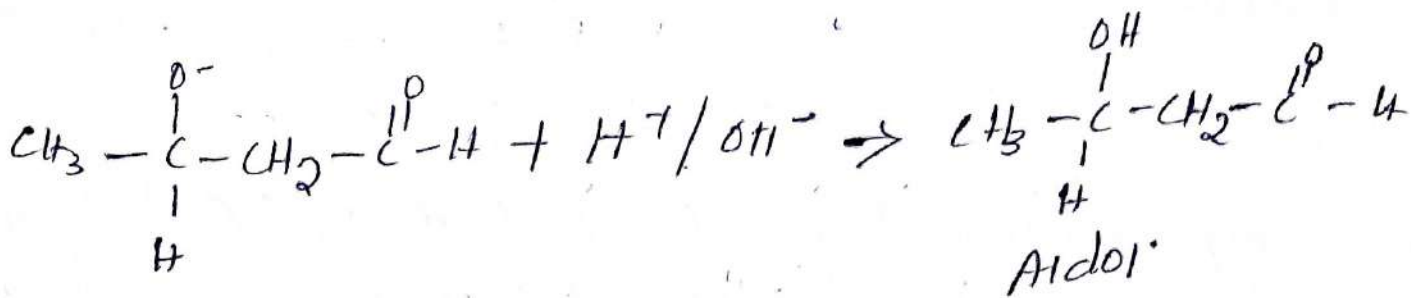
Step-II

nucleophile attacks the aldehyde and electrophilic carbon atom.



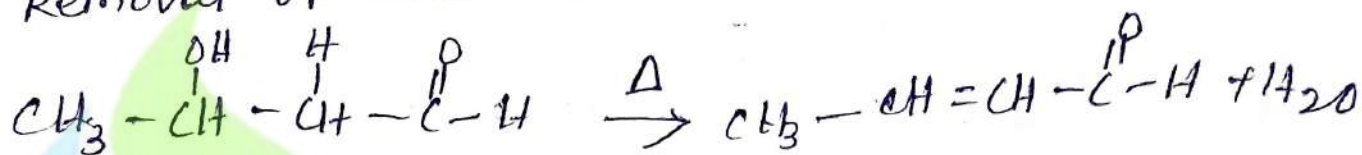
Step-III

Removal of H^+ from water form aldo,



Final step

Removal of water molecule from Aldol compound



Long question answer :

Q3) Outline the general method of preparation and chemical reaction of aldehyde.

A) The general method for preparing aldehyde is through the oxidation of primary alcohols where the alcohol is partially oxidized to form an aldehyde using an oxidizing agent like potassium permanganate (KMnO_4) or potassium dichromate.

Key points of aldehyde preparation :

Starting material : Primary alcohols are the primary starting material for aldehyde synthesis.

oxidation process: A suitable oxidizing agent is used to remove two hydrogen atoms from the alcohol molecule result the formation of a carbonyl group (C=O) characteristics of aldehydes

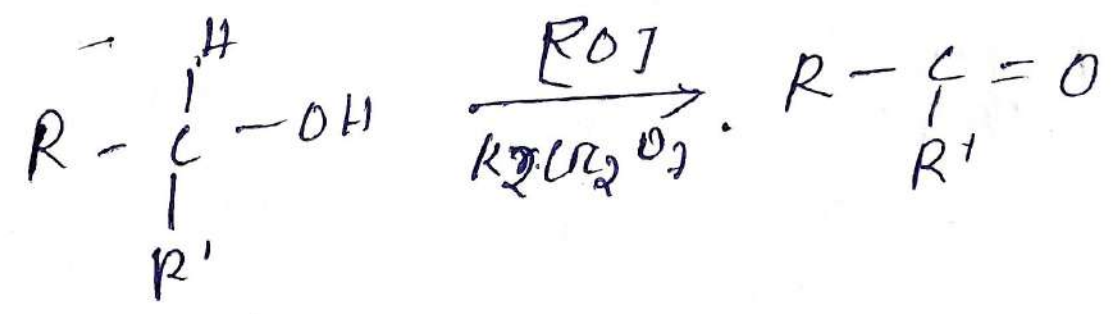
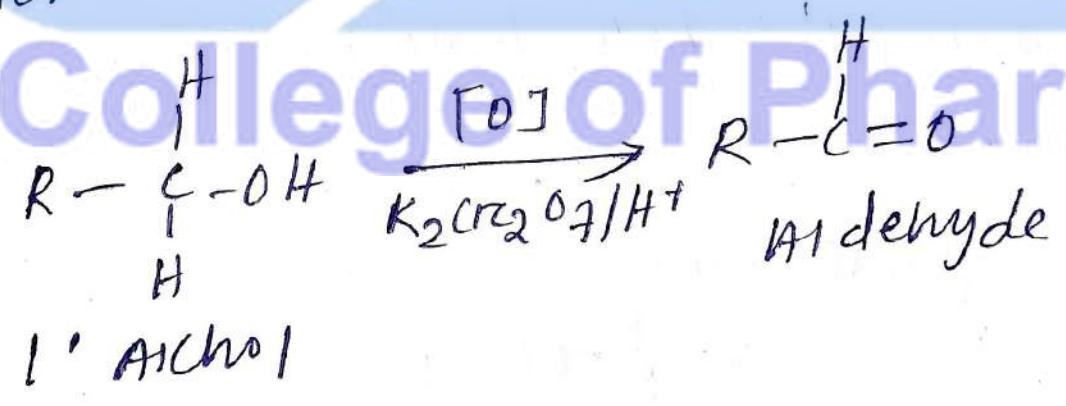
chemical formula: The general formula for an aldehyde is R-CHO where R is present for a hydrocarbon chain

Other methods of aldehyde preparation

- Dehydrogenation of alcohols
- Ozonolysis of alkenes
- Hydrolysis

general structure of formation of aldehyde

College of Pharmacy



Q4) Discuss S_N1 and S_N2 reaction factors affecting S_N1 and S_N2 reaction.

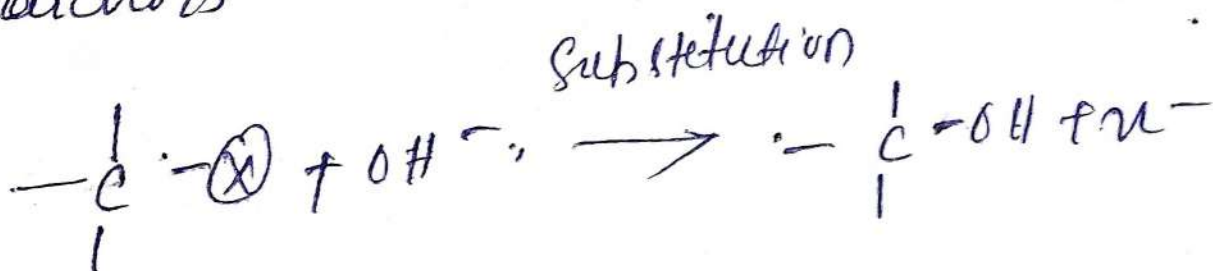
1) S_N1 and S_N2 reactions are nothing but simply a type of nucleophilic substitution reaction.

- A nucleophilic substitution reaction is a type of organic reaction in which an atom or group of an atom is replaced from substrate of a ~~reactant~~ nucleophile.

- The substitution occurs either in one or two steps.

- The two step mechanism is known as S_N1 reaction while the one step mechanism known as S_N2 reaction.

- Nucleophilic ~~reactions~~ substitution mainly occurs on alkyl halide and alcohols



Alkyl
halide

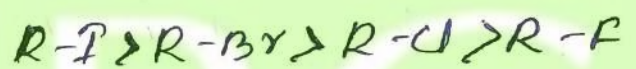
Nucleo
phile

Factor affecting S_N1 and S_N2

Nature of alkyl halide \div Reactivity order of alkyl halide for S_N1
 $3^\circ > 2^\circ > 1^\circ$

- Reactivity order of alkyl halide for S_N2
 $1^\circ > 2^\circ > 3^\circ$

Nature of leaving group \div more easily leaving group remove from carbon atom faster will be substitution reaction



Nature of solvent \div generally polar protic solvent are used in S_N1 reaction

- polar aprotic solvents are used for S_N2 reaction

Q5) write a note on structural isomerism with suitable example? Discuss the IUPAC system or nomenclature of Alcohol and Carboxylic acid

1) Structural isomerism refers to the phenomenon where compounds have the same molecular formula but different in the arrangement of atoms.

Types of Structural isomerism:

- 1) Chain isomerism: Different carbon chain
- 2) Position isomerism: Same functional group but located at different position on the carbon chain
- 3) Functional group isomerism: Different functional group with the same molecular formula.
- 4) Tautomeric isomerism: Compounds that exist in equilibrium with one and another typically involving the shift of a hydrogen atom and a double bond.

The IUPAC system of nomenclature provides a standardized way of naming the organic compound based on their structure.

Alcohols :-

- That contains the hydroxyl group (OH)
- That the hydroxyl group on the lowest numbered carbon
- The suffix -ol is added to the root name hydrocarbon.

if there are multiple hydroxyl groups use prefix
like diol, triol
Ex: Ethanol

Carboxylic acid:

- containing the carbonyl group
- so that the carbonyl group is on carbon 1
- the suffix -oic acid is added to the root + name of the hydrocarbon

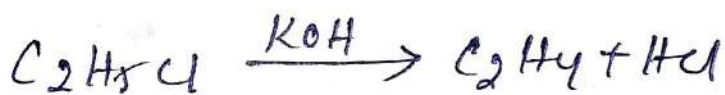
Example - Acetic Acid

Q6) Describe five general methods and preparation of alkenes?

1) ① Dehydrohalogenation: It typically occurs in the presence of a strong base like potassium hydroxide (KOH) and sodium hydroxide.

Ex: Preparation of Ethene.

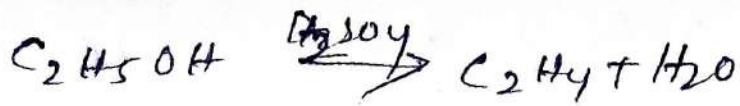
Ethyl chloride undergoes the elimination with KOH in ethanol to form ethene



2) Dehydration of alcohol.

- Preparation of Ethene

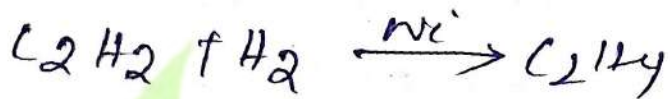
Ethanol $\text{C}_2\text{H}_5\text{OH}$ undergoes dehydration with H_2SO_4 to form ethene



③ Reduction of alkynes

Preparation of ethene

Acetylene reacts with hydrogen in the presence of catalyst to form ethene



④ Wittig reaction

Preparation of stilbene →

A ketone reacts with phosphonium ylide to form stilbene



⑤ Bromine addition followed by elimination

Preparation of 1,3, Butadiene

1,4 dichlorobutane undergoes dehydrochlorination to form 1,3, butadiene an alkene

Thank you