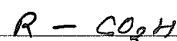
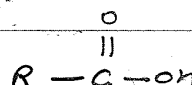


Unit = V

# CARBOXYLIC ACIDS

Organic Compounds which contains functional group (-COOH) are called carboxylic Acid.

There General formula ;



where = R; alkyl group

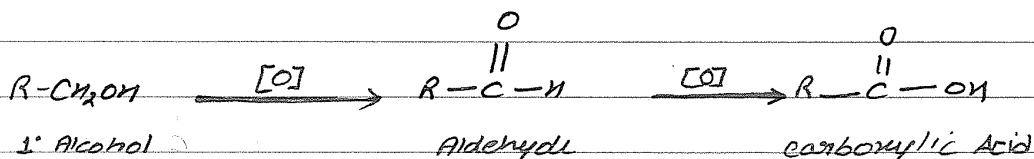
X The name Carboxyl derived from Carbonyl (C=O) + Hydroxyl (-OH) because in the Carboxyl group, these two groups are directly bonded to each other.

## METHOD OF PREPARATION

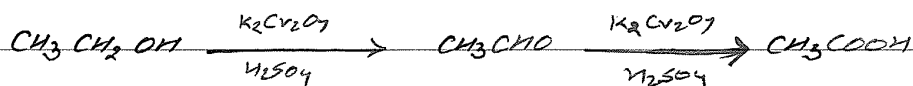
### 1) Oxidation of Primary Alcohols or Aldehydes.

primary Alcohols or Aldehydes undergo oxidation with a mixture of potassium dichromate + sulfuric acid to form Carboxylic Acids. The Alcohol first oxidized to an Aldehyde, then to a Carboxylic Acid.

#### General Reaction



#### Example

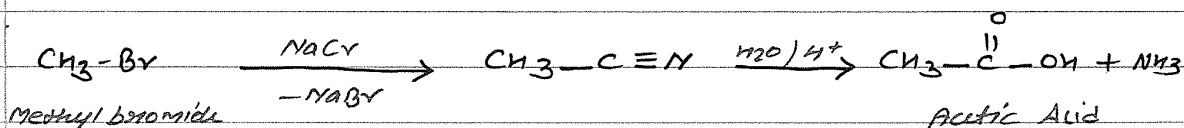
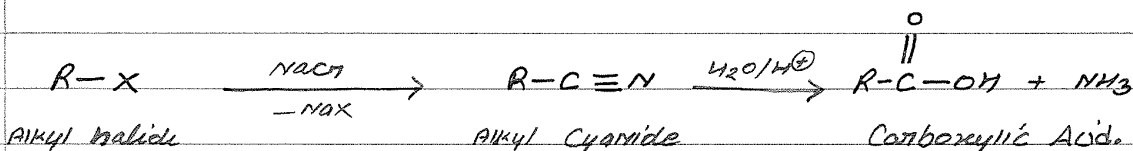


### 2) Hydrolysis of Nitriles

Nitriles or alkyl Cyanides are compounds with the general formula  $R-C \equiv N$ .

They are prepared by treating alkyl halides with Sodium cyanide. The nitriles on acid-hydrolysis form Carboxylic Acids.

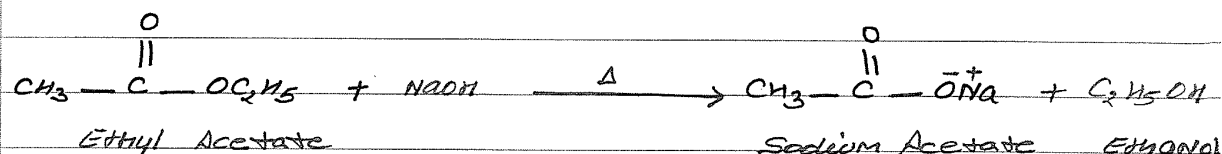
#### General Reaction



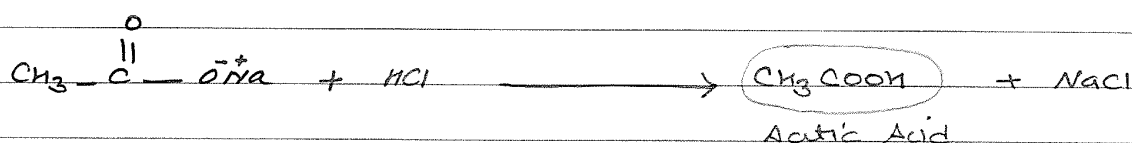
### 3. Hydrolysis of Ester

When an ester is boiled with concentrated  $\text{Ag-NaOH}$ , sodium salt of the acid are formed. Next this further treated with  $\text{dil-HCl}$  gives the corresponding Carboxylic Acid

Reaction :- ~~step~~ I



500 - 11



#### 4 Carboxylation of Alkenes.

Alkene heated with Carbon monoxide with steam under pressure with phosphoric acid ( $H_3PO_4$ ) at  $400^\circ C$  Carboxylic Acid formed.

Reaction.

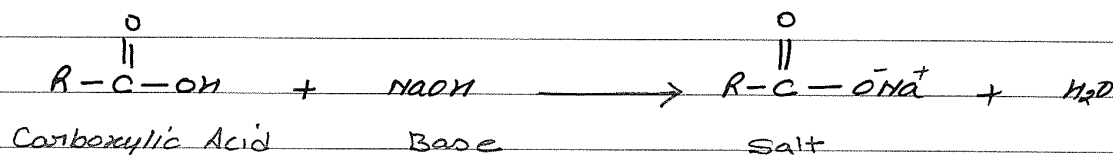


Ethylene.

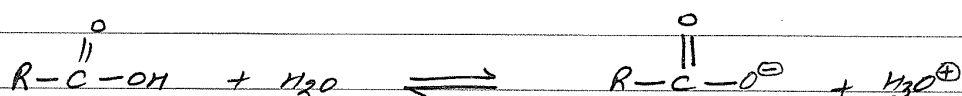
propionic Acid

# Acidity of Carboxylic Acid.

Carboxylic acid are acidic in nature. They will donate a proton & form salt with Base.



Acidity Constants Strong Acid (eg  $\text{HCl}$  &  $\text{H}_2\text{SO}_4$ ) completely ionize in Aq-solution. Carboxylic Acids are weak Acid. They are only partially ionized in Aq-solution and an Equilibrium exists b/w the ionized & unionized forms.



The extent of ionization is described by an [Equilibrium constant  $K_a$ ] is known as Acidity constant.

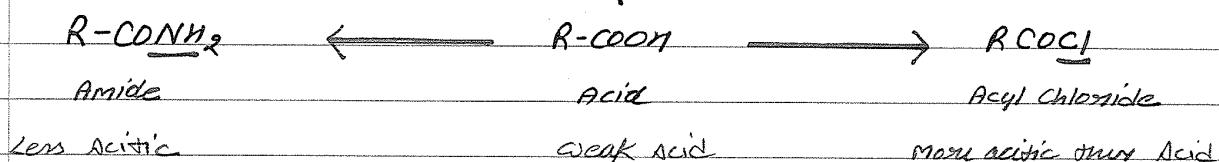
It is defined as the concentration of the products of ionization in moles per liter divided by the conc of unionized Acid

$$K_a = \frac{[\text{RCOO}^-][\text{H}_3\text{O}^+]}{[\text{RCOOH}]}$$

The acidity constant describes the relative strength of a weak Acid. Strong Acids will have higher numerical value of Acidity Constants.

## Effect of Substituents on Acidity.

- a) Electron withdrawing group (Cl, Br, F) Increases Acidity  
Electron withdrawing group withdraws Electron density from the Carboxyl group and Equilibrium shifted to right that Increases Acidity of Carboxylic Acid.
- b) Electron donating group (OH, NH<sub>2</sub>) Decreases Acidity  
Electron donating group adds Electron density to Carboxyl gp and (Equilibrium shifted to left) that Decreases Acidity of Carboxylic Acid.

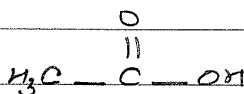


## Qualitative Tests

- 1 Litmus paper Blue litmus paper turn into Red coming in contact with Carboxylic Acid.
- 2 Ester Test Carboxylic Acids Reacting Alcohol presence of conc. Sulfuric Acid form fruitly smelling Ester.
- 3 Sodium Hydrogen Carbonate Carboxylic Acid reacting with sodium hydrogen Carbonate Release  $\text{CO}_2$  gas.

## STRUCTURE & Uses.

### 1. Acetic Acid ( $\text{CH}_3\text{COOH}$ )



#### USES

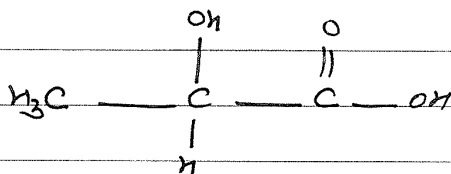
Used as ingredient in production of plastic bottles.

In food industry used as acidity regulator.

Dilute Acetic Acid used as cleaning agent.

Used as mild antibacterial agent.

### 2. Lactic Acid ( $\text{C}_3\text{H}_5\text{O}_3$ )



#### USES.

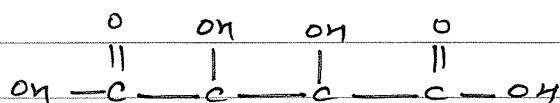
Used as moisturiser in some cosmetics.

Used for making yogurt & cheese.

Used in tanning leather.

Used manufacturing lacquers & inks.

3. Tartaric Acid ( $C_4H_6O_6$ )



Uses

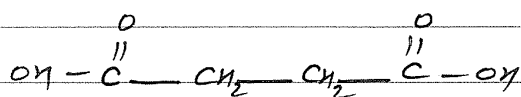
Used in pharmaceutical preparations  
Used cleaning & polishing metals.  
Used for cleaning Brans  
Used as Insecticide.

4. Citric Acid ( $C_6H_8O_7$ )

Uses.

It is useful components of frozen foods.  
It used in food as a flavouring Agent & preservative.  
It used as chelating Agent in soaps.  
It used to control pH.

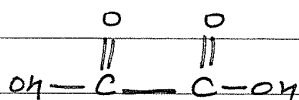
5. Succinic Acid  $C_4H_6O_4$



Uses.

used as flavouring Agent in food Industry.  
used as a buffer.  
used in pharmaceutical manufacturing of  
Sedatives, Anti-inflammatory, Anti-cancer.

6. Oxalic Acid  $C_2H_2O_4$



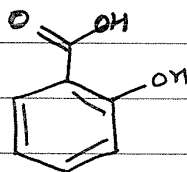
Uses.

Used as a cleaning Agent

In textile mills & factories, used as Bleaching cloth

Used in medicinal preparations

7. Salicylic Acid  $(C_7H_6O_3)$



uses

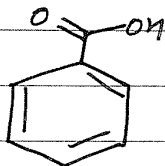
It is used as Bacterial & fungal Agent

It is " " Anti-inflammatory Agent.

It is " " food preservatives.

It is " " ingredient many skin care products.

8. Benzoic Acid  $(C_7H_6O_2)$



uses

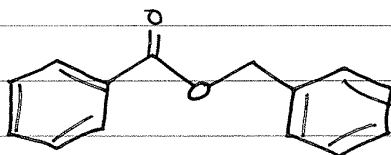
used as food preservatives

It is precursor for many organic substances.

It is used for treating fungal diseases.

9

Benzyl Benzoate ( $C_{14}H_{12}O_2$ )



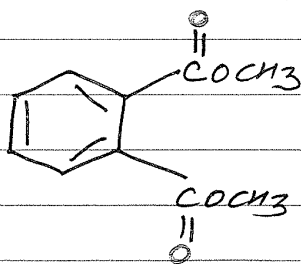
Uses

It is used to treat scabies since ancient times.

It is used for pediculosis.

10

Dimethyl Phthalate ( $C_{10}H_{10}O_4$ )



uses

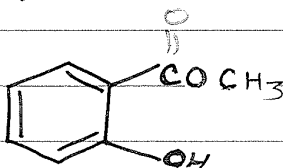
It is anti-parasitic drug

It is used in tropical preparations

It is used in solvent, odourant, cosmetics.

11.

Methyl Salicylate ( $C_8H_8O_3$ )

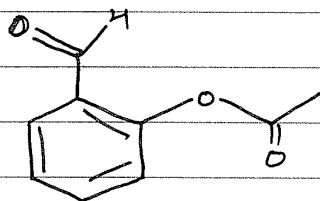


uses

It is flavouring Agent

It is used in treating rheumatic pain

11. Acetyl Salicylic Acid ( $C_9H_8O_4$ )



Uses.

used to treat fever + mild to moderate pain.

\_\_\_/\_\_\_/\_\_\_