
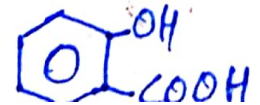


CARBOXYLIC ACID

- Functional group. = $(-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH})$

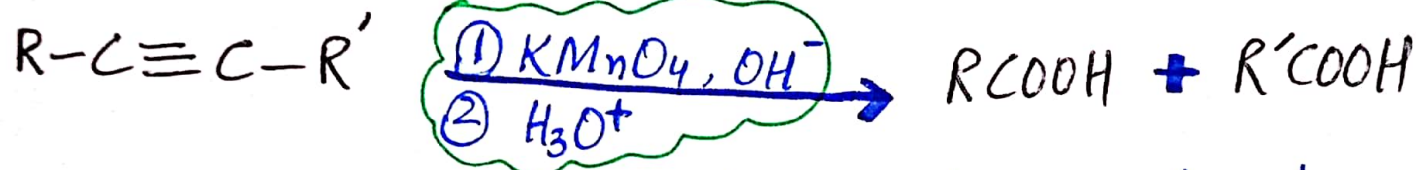
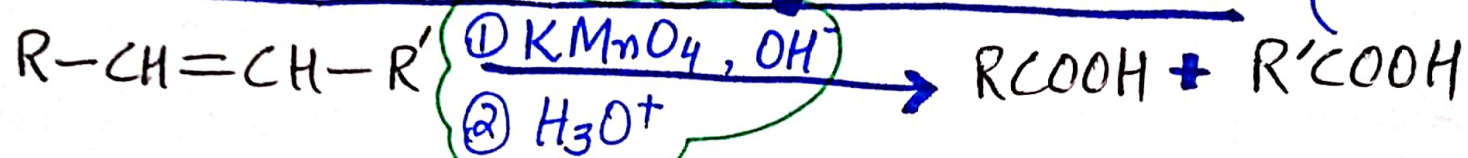
Long chains of carboxylic acid = fatty acids.

- Palmitic acid = $\text{C}_{15}\text{H}_{31}\text{COOH}$
- Stearic acid = $\text{C}_{17}\text{H}_{35}\text{COOH}$
- Oleic acid = $\text{C}_{17}\text{H}_{33}\text{COOH}$
- Linoleic acid = $\text{C}_{17}\text{H}_{31}\text{COOH}$
- Formic acid = HCOOH
- Benzoic acid = 
- Acetic acid = CH_3COOH
- Oxalic acid = $\text{HOOC}-\text{COOH}$
- Malonic acid = $\text{HOOC}-\text{CH}_2-\text{COOH}$
- Butyric acid = $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- Adipic acid. = $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- Salicylic acid (tallow) = 

● Carboxylic Carbon has highest possible oxidation state (+3)

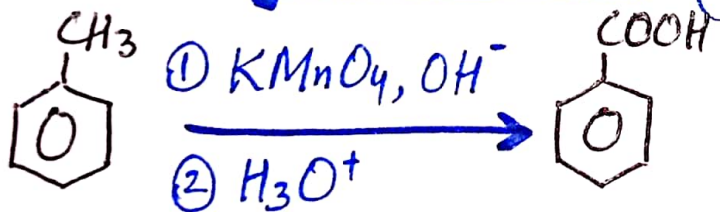
PREPARATORY METHODS:

1. From unsaturated hydrocarbons: (Oxidation)



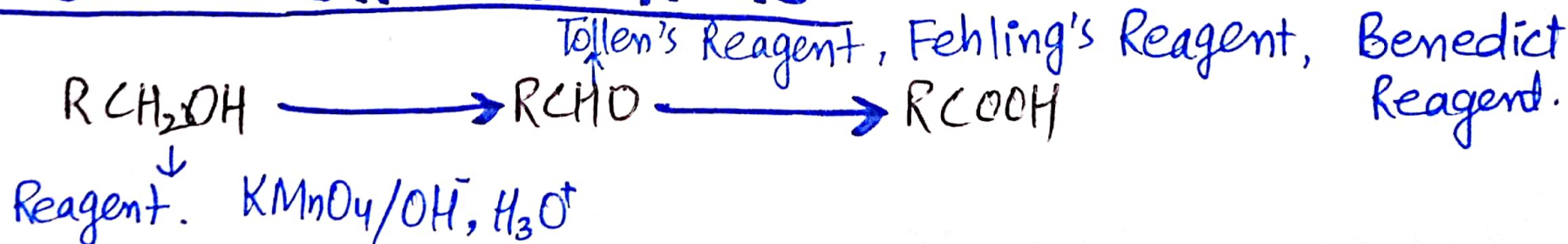
- Acidic dichromate or nitric acid can also be used.
- to locate position of unsaturation.

2. From alkylbenzene: (Oxidation)

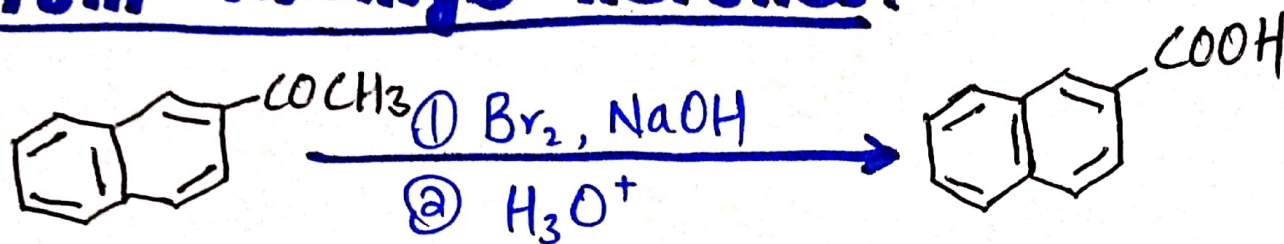


Acidic dichromate or nitric acid can also be used.

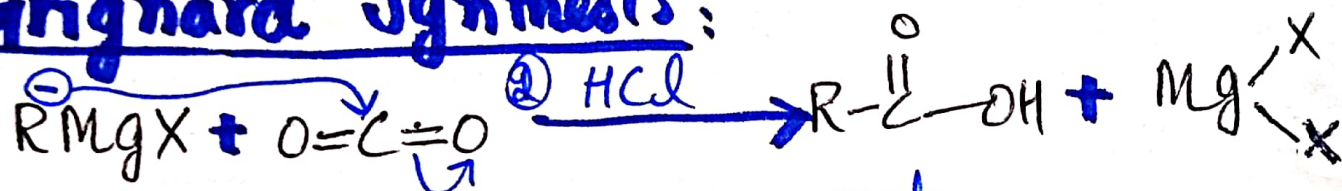
3. From 1°-OH and RCHO:



4. From methyl ketones:



5. Grignard Synthesis:



• Carbonation of Grignard reagent.

• $R = 1^\circ$ or 2° or 3° or allyl or Benzyl or Aryl.

6. From alkyl nitriles: (Hydrolysis)



• in neutral or acidic or basic conditions.

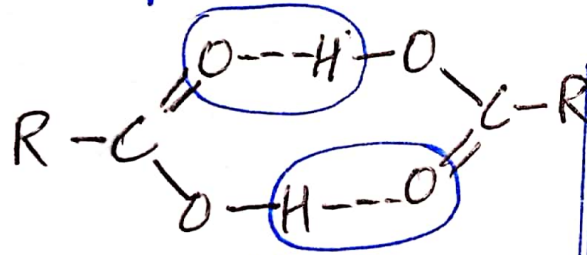
7. From Esters: (Hydrolysis).



• Reverse of esterification

PHYSICAL PROPERTIES:

- Monocarboxylic acid of lower aliphatic carboxylic acid are liquids.
- Form H-bonding with water, C_1-C_4 readily soluble in water.
- Exist in dimeric forms
- Odour = sharp irritating to distinctly unpleasant.



- M.P° increases with increase in mol. wt.

- Even carbon acid has higher M.P° than odd C acid.

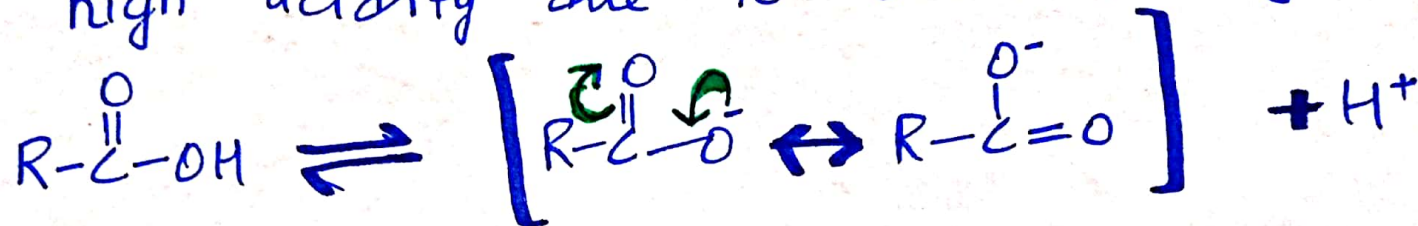
- Have high acidity when

E.W.G is attached near $-COOH$ group or on Aromatic ring containing carboxylic group.

	M.P°	B.P°
$HCOOH$	8.4	101
CH_3COOH	16.6	118
C_2H_5COOH	-21	141
C_3H_7COOH	-6	164
C_4H_9COOH	-36	

• $\text{Cl}_3\text{CCOOH} > \text{Cl}_2\text{CHCOOH} > \text{ClCH}_2\text{COOH} > \text{CH}_3\text{COOH}$
 → order of acidity.

• Show high acidity due to stable conjugate base.

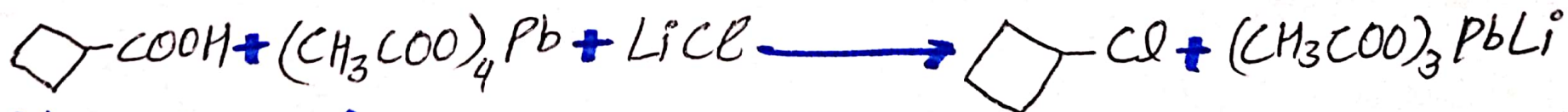


CHEMICAL REACTIONS:

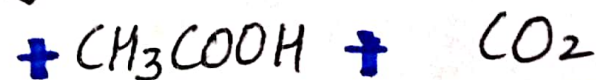
1. Behaves as acid: (Salt formation)
 with Na, Ca, Mg, Zn, Al etc.



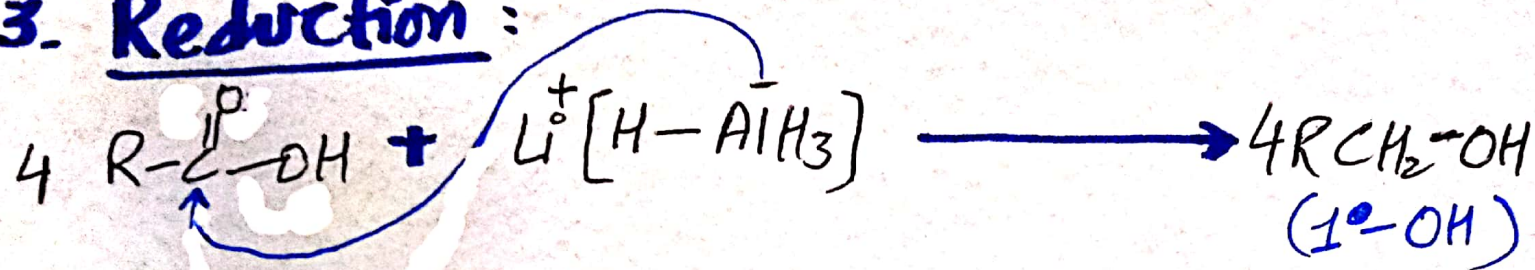
2. Kochi Reaction: (Decarboxylation).



• With 2° or 3°-COOH.



3. Reduction:

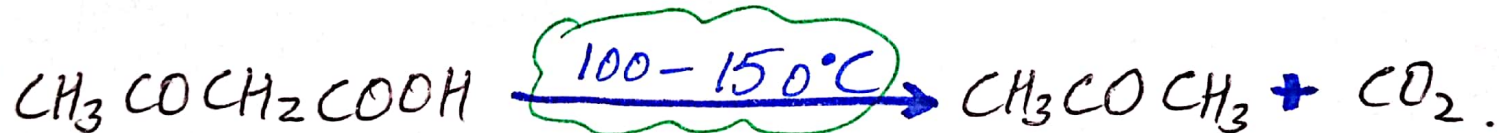
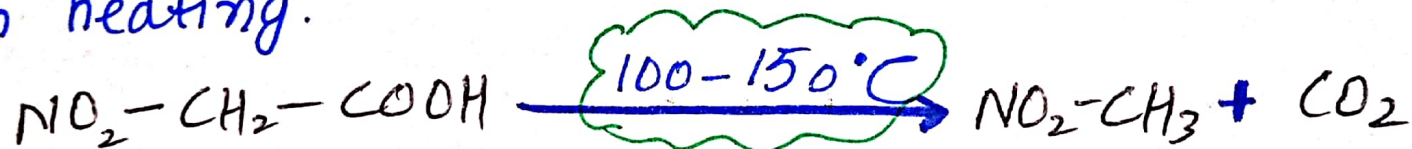


- Not much important, alcohols more readily available than carboxylic acids.



4. Decarboxylation.

A. on heating.



B. Hunsdieker Rxn:

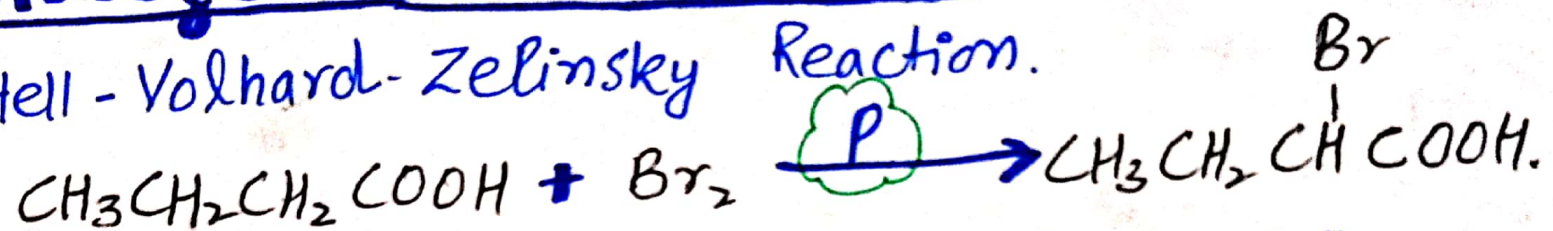


- Free radical mechanism, best for 1°-COOH .

C. Kochi Rxn.

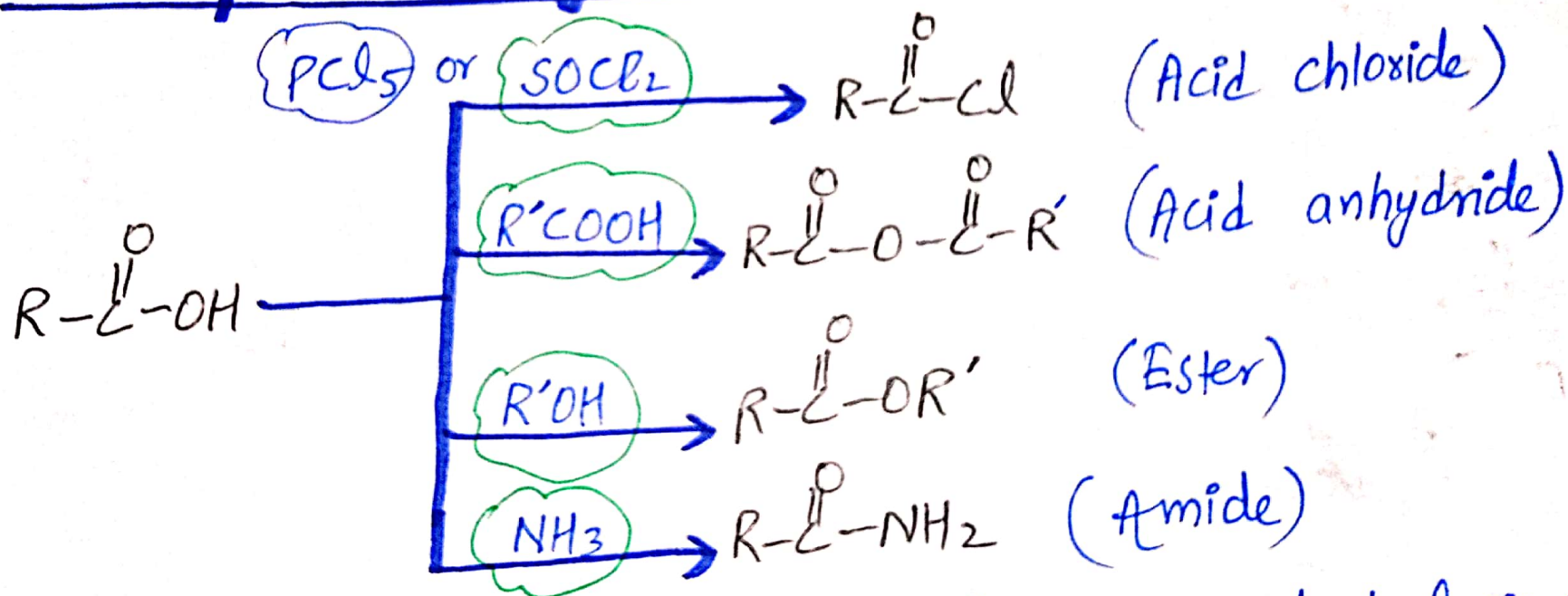
5. Halogenation at α -C:

- Hell-Volhard-Zelinsky Reaction.



- α -bromo acid — important synthetic intermediates — can undergo nucleophilic displacement and elimination reactions easily.

6. Nucleophilic acyl substitution:

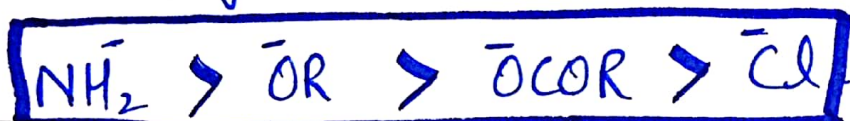


- Derivatives can be converted to RCOOH on hydrolysis.
- Can be interconverted.

• Order of reactivity:



due to basicity order.



Derivative	Uses/Reactions.
$-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl}$	<ul style="list-style-type: none"> • can be converted to <ul style="list-style-type: none"> acyl peroxide. ($\text{Na}_2\text{O}_2, \text{CHCl}_3$) carboxylic acid (H_3O^+) Anhydride (RCOOH/Py) ester (ROH/Py) amide (NH_3) Aldehyde (Rosemund reduction) • used as acylating agent.
$-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-$	<ul style="list-style-type: none"> • can be converted to <ul style="list-style-type: none"> carboxylic acid (H_3O^+) Ester (ROH) Amide. (NH_3) • used as acylating agent.
$-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}$	<ul style="list-style-type: none"> • can be converted to <ul style="list-style-type: none"> Amide. (NH_3) carboxylic acid. (H_3O^+) other ester ($\text{R}''\text{OH}$) 1°-Alcohol (LiAlH_4 or $\text{CuO} \cdot \text{Cr}_2\text{O}_3$) • Alkaline hydrolysis (Saponification)



• converted to $\begin{cases} \text{Carboxylic acid (H}_2\text{O)} \\ \text{Amine. (LiAlH}_4 \text{ or } \text{Br}_2, \text{NaOH)} \end{cases}$

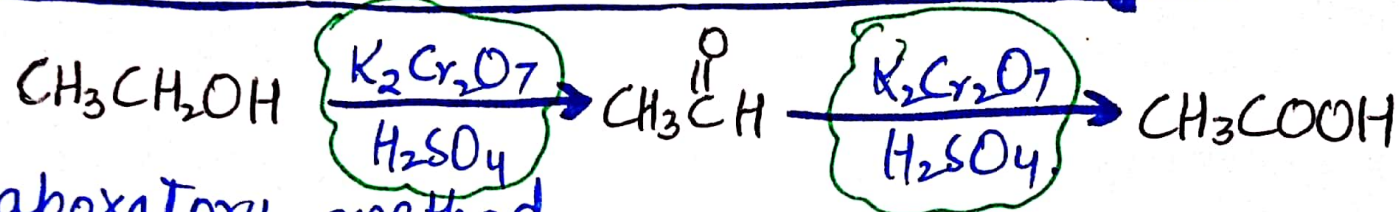
• Esters are used as flavouring agents:

Amyl acetate	BANANA
Benzyl acetate.	JASMINE
Methyl butyrate.	APPLE
Ethyl butyrate	PINEAPPLE
Octal acetate.	ORANGE
Amyl Butyrate.	APRICOT
Isobutyl formate.	RASBERRY

ACETIC ACID (CH_3COOH)

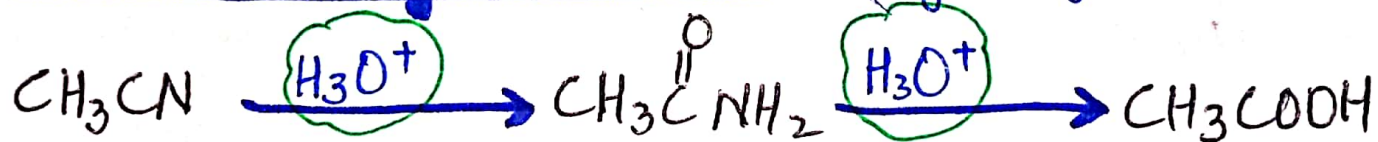
PREPARATORY METHODS

01. From Ethanol or Acetaldehyde (Oxidation)



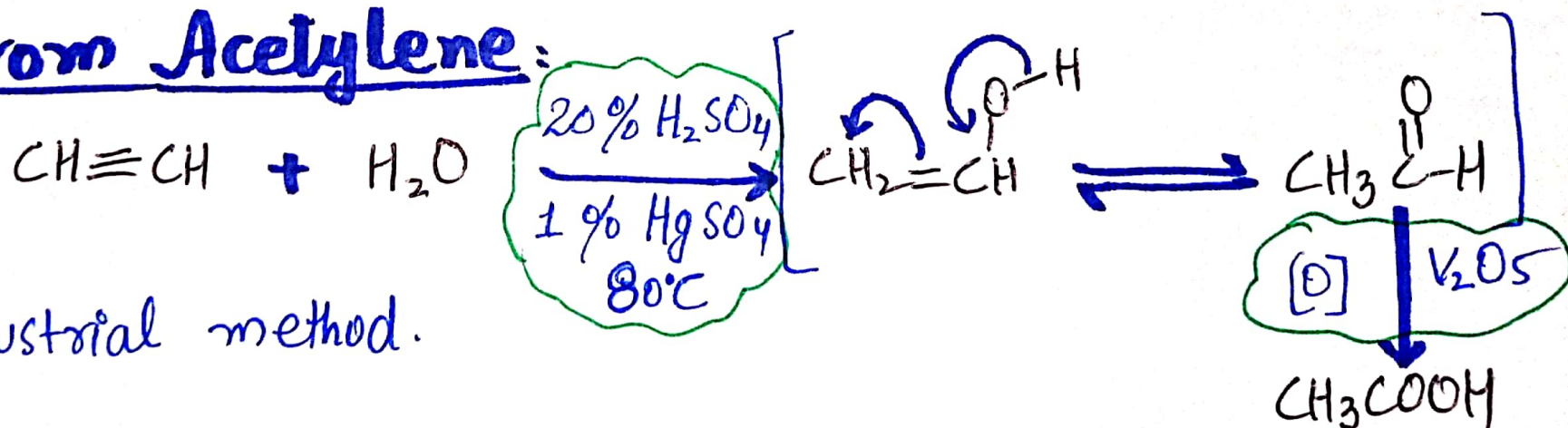
- Laboratory method.

02. From methyl Nitrile : (Hydrolysis with dil. acid)



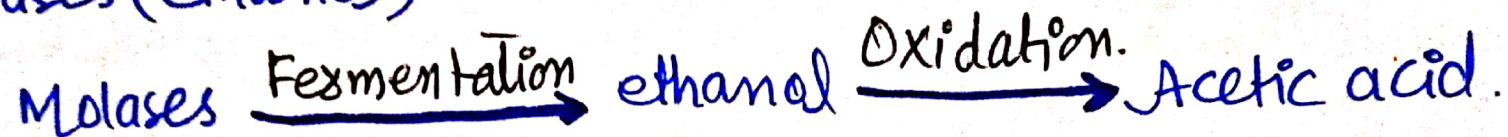
- Laboratory method.

03. From Acetylene :



- Industrial method.

- Acetic acid is prepared on industrial scale from molasses (ethanol)



PHYSICAL PROPERTIES:

- Colourless liquid. with vinegar like odour
- Sour taste.
- B.P° = 118°C
- Pure acid freezes like ice below 17°C (Glacial Acetic acid)
- Miscible with water, ethanol and ether.

Uses:

- Coagulant for latex
- manufacturing of plastic (Polyvinyl acetate), rayon and silk
- local irritant.
- solvent
- manufacturing of pickle
- manufacturing of many organic compounds.