

# PROPERTIES OF CARBOXYLIC ACIDS

19/11/2023

MEDICINE AND SURGERY

CHEM102: ASSIGNMENT (CARBOXYLIC ACIDS)

- $\text{HCOOH} \rightarrow$  Methanoic acid
- $\text{HOOC(CH}_2\text{)}_3\text{COOH} \rightarrow$  Pentan-1,5-dioic acid
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  Butanoic acid
- $\text{HOOC-COOH} \rightarrow$  Ethanedioic acid
- $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}=\text{COOH} \rightarrow$  Hex-4-enoic acid

## 2. PROPERTIES OF CARBOXYLIC ACIDS:

- $\Rightarrow$  PHYSICAL APPEARANCE: All simple aliphatic acids up to  $\text{C}_{10}$  are liquids at room temperature. Most of the other carboxylic acids are solid at room temperature. While aromatic carboxylic acid or aliphatic acid aliphatic ethanoic acid freezes to an ice-like solid at room temperature.
- $\Rightarrow$  BOILING POINT: Aromatic carboxylic acids are crystalline solids and have higher melting points than aliphatic carboxylic acids. Boiling point increases with relative molecular mass.
- $\Rightarrow$  SOLUBILITY: All carboxylic acids with low molecular mass with up to four carbon atoms are soluble in water due to the ability to form hydrogen bonds with the water molecule. All carboxylic acids are soluble in organic solvents. The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature hence insoluble.

## 3. INDUSTRIAL PREPARATION OF CARBOXYLIC ACIDS

- $\rightarrow$  FROM ETHANOL: Ethanoic acid is obtained commercially by the liquid phase air-oxidation of ethanol solution of ethanol to ethanoic acid using manganese(II) ethanoate as catalyst. Ethanol itself is obtained from ethylene to yield ethene.

Ex



4. USES OF ETHYLENE OXIDE

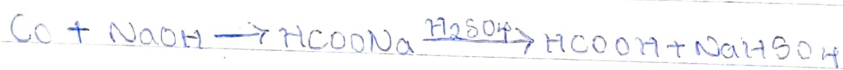
⇒ It is used as a gaseous sterilizing agent.

⇒ It is used as an intermediate in the hydrolytic manufacture of ethylene glycol.

⇒ It is used in preparation of nonionic emulsifying agents, plastics, plasticizers and several synthetic terpolyesters.

⇒ FROM CARBON DIOXIDE:

Methanoic acid (formic acid) is manufactured by adding carbon (II) oxide under pressure to ~~an~~ aqueous solution of NaOH. The free carboxylic acid is liberated by the careful reaction with Tetraoxosulphuric acid ( $\text{H}_2\text{SO}_4$ ).

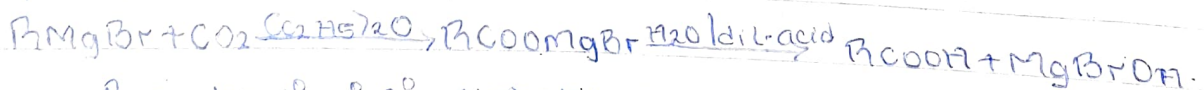


4. SYNTHETIC PREPARATION OF CARBOXYLIC ACID:

a. Oxidation of primary alcohols and aldehydes by using the usual ~~and~~ oxidizing agents  $\text{H}_2\text{Cr}_2\text{O}_7$  or  $\text{KMnO}_4$ .

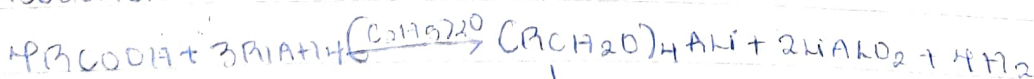


b. Carbonation of Grignard reagent: Aliphatic carboxylic acids are obtained by burning carbon (IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid.

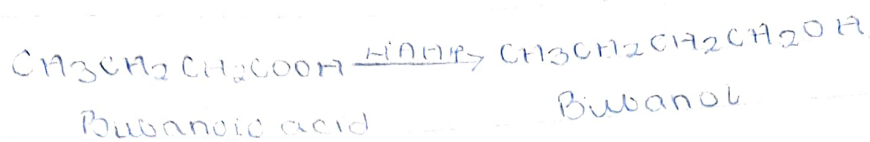


Rmg be  $1^\circ, 2^\circ, 3^\circ$  aliphatic alkyl or aryl radical.

5a. Reduction

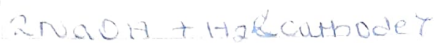
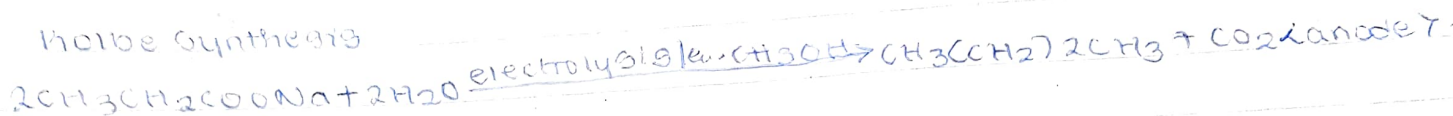


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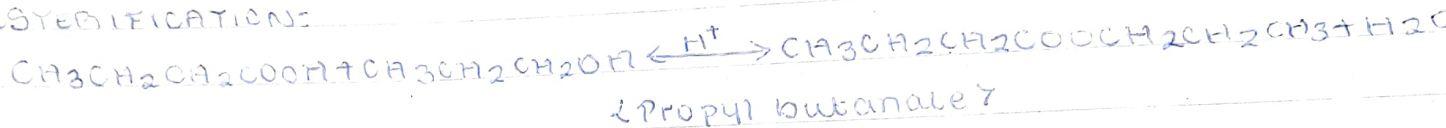


B. DECARBOXYLATION:

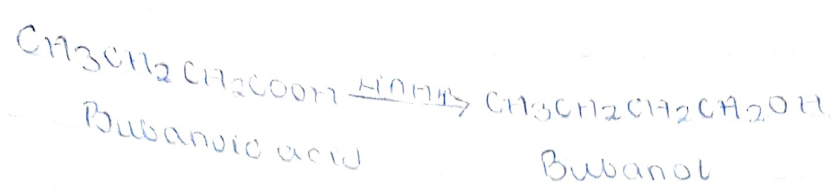
Hofmann Synthesis



C. ESTERIFICATION:

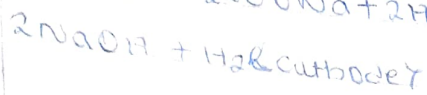
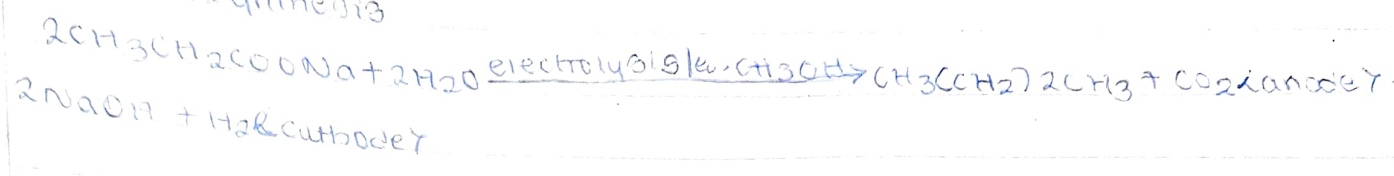


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b. DECARBOXYLATION:

Kolbe synthesis



c. ESTERIFICATION:

