

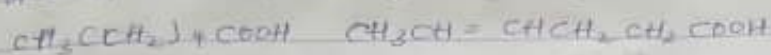
ANAYI BURKOLA PRECIOUS

NURSING

19/MHS 02 1012

CHM 102 ASSIGNMENT

1) Give the IUPAC name of the following compounds



Answer

$\text{HCOOH}$  - Methanoic acid

$\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$  - Pentan-1,5-dioic acid

$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$  - Butanoic acid

$\text{HO}_2\text{C}-\text{CO}_2\text{H}$  - Ethanedioic acid

$\text{CH}_3\text{C}(\text{CH}_3)_4\text{COOH}$  - Hexanoic acid

$\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$  - Hex-4-enoic acid

2) Discuss briefly the physical properties of carboxylic acids under the following headings.

i) Physical appearance ii) Boiling point iii) solubility

Answer

i) Physical appearance: All simple aliphatic carboxylic acids up to  $\text{C}_{10}$  are liquids at room temperature. Most other carboxylic acids are solid at room temperature although carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

ii) Boiling point: Boiling point increases with increasing molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting point than their aliphatic counterparts of comparable relative molecular mass.

iii) Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water. This is due to their ability to form hydrogen bonds with water molecules.

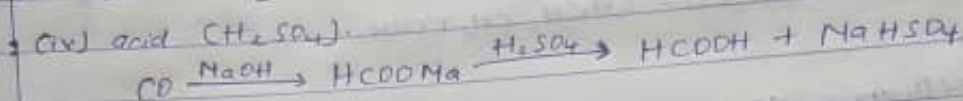
The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

3) Write two industrial preparations of carboxylic acids

Answer

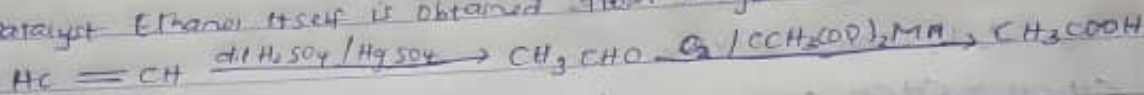
i) From Carbon Dioxide

Methanoic acid (formic acid) is manufactured by adding carbon dioxide under pressure to hot <sup>aqueous</sup> solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphuric acid (H<sub>2</sub>SO<sub>4</sub>).



ii) From Ethanol

Ethanoic acid is obtained commercially by the liquid phase air oxidation of 5% solution of ethanol to ethanoic acid using manganite (Mn) ethanoate catalyst. Ethanol itself is obtained from ethylene.

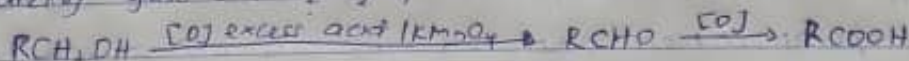


4) With equations and brief explanation, discuss the synthetic preparation of carboxylic acid.

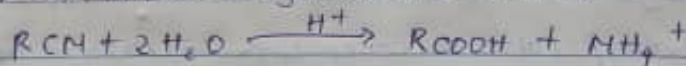
Answer

i) Oxidation of primary alcohols and aldehydes

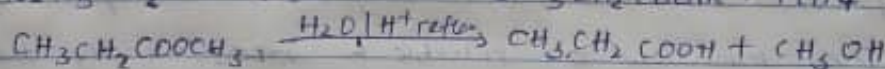
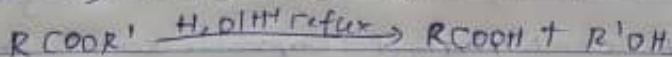
This method can be used to prepare carboxylic acids using the usual oxidizing agents (i.e. K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> or KMnO<sub>4</sub>) in acidic solution.



ii) Hydrolysis of nitrile (cyanides) or esters



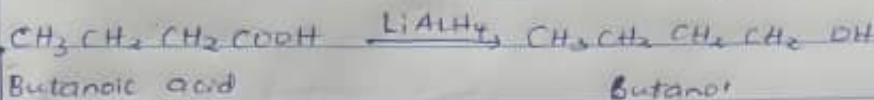
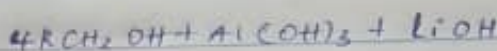
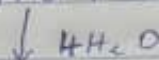
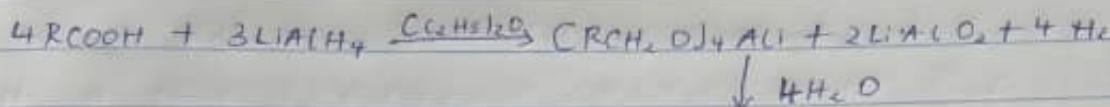
(R = alkyl or aryl radical)



5) with chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

Answer

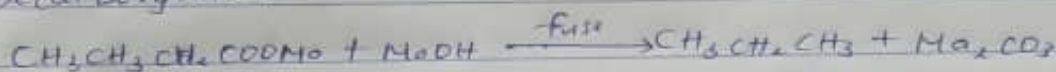
i) Reduction



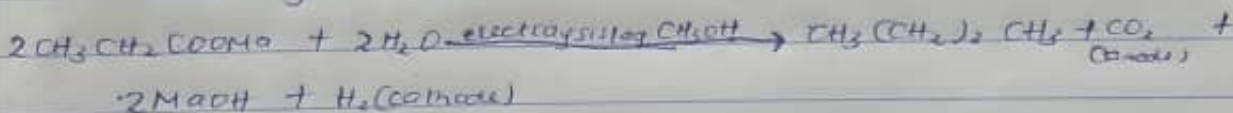
Butanoic acid

Butanol

ii) Decarboxylation



Kolbe Synthesis



iii) Esterification

