

JHECHERE NNABUEZE WILSON

19/MHS01/198

MBBS

CHM 102

Assignment

Write the IUPAC names of the following compounds

$\text{HCOOH}$  - 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

$\text{CH}_3(\text{CH}_2)_4\text{COOH}$  - Hexanoic acid

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

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



$\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_2-\text{COOH}$  - HOOC-4-enoic acid.

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

i Physical appearance (ii) Boiling point (iii) solubility

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

ii Boiling point: Boiling point of carboxylic acid increases with increasing relative molecular mass. In aromatic forms



Note: Methane is prepared through the methylation of Alkyl Halides:

and crystalline solids and have higher melting point than their aliphatic counterparts with comparable relative molecular mass.

iii Solubility: Lower molecular mass carboxylic acids containing few carbon atoms are soluble in water due to formation of hydrogen bonds with water molecules. The higher the relative molecular mass, the lower the water solubility due to the presence of ~~the~~ structure becomes more hydrocarbon in nature and thus covalent. All carboxylic acids are soluble in organic solvents.

3 Write two industrial preparations of carboxylic acid.

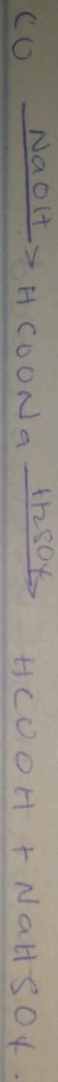
i) From carbon dioxide: Formic acid (methanoic acid) is prepared by adding carbon dioxide under pressure to hot



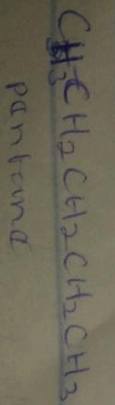
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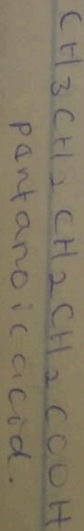
i) From carbon(II) oxide: Formic acid (methanoic acid) is ~~formed~~ manufactured by adding carbon(II) oxide under pressure to hot aqueous solution of ~~NaOH~~  $\text{H}_2\text{SO}_4$ . Carboxylic acid is liberated by ~~reverse~~ reaction with  $\text{H}_2\text{SO}_4$ .



ii) From petroleum: Liquid phase air oxidation of C<sub>6</sub>-C<sub>7</sub> alkanes obtained from petroleum at high temperature and pressure will give C<sub>6</sub>-C<sub>7</sub> carboxylic acids with malonic, propionic and butanedioic acids as by-products.

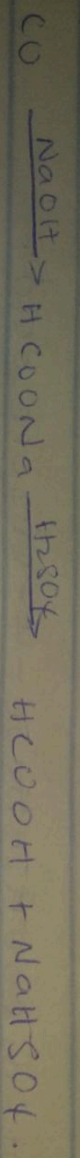


$\xrightarrow{\text{O}_2 \text{ (high temp and press.)}}$

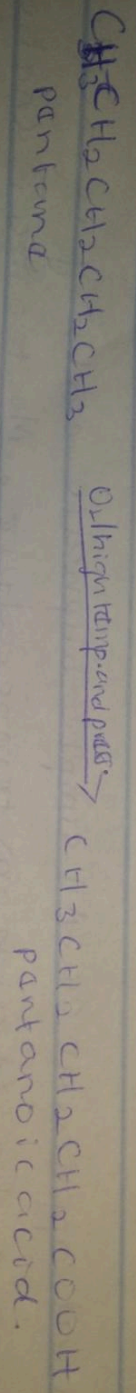


4 Write equations and brief explanation, discuss the synthesis





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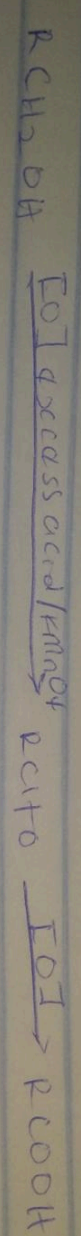


ii With equations and brief explanation, discuss the synthetic preparation of carboxylic acid.

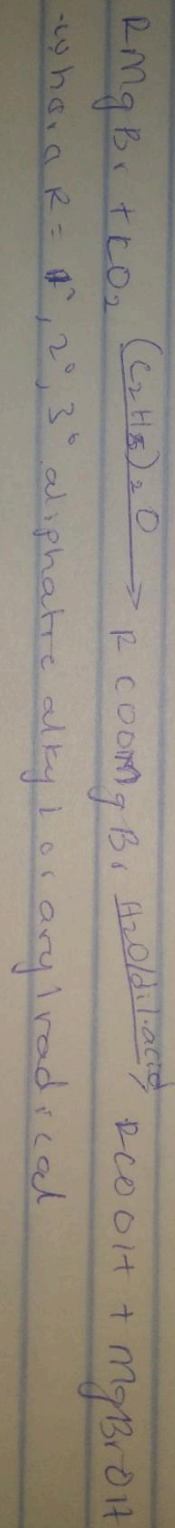
• Oxidation of primary alcohol/aldehydes: This can be used to prepare carboxylic acids using the usual oxidizing agents in acidic solution.

pared through the method

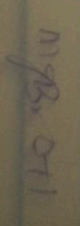
with zinc and



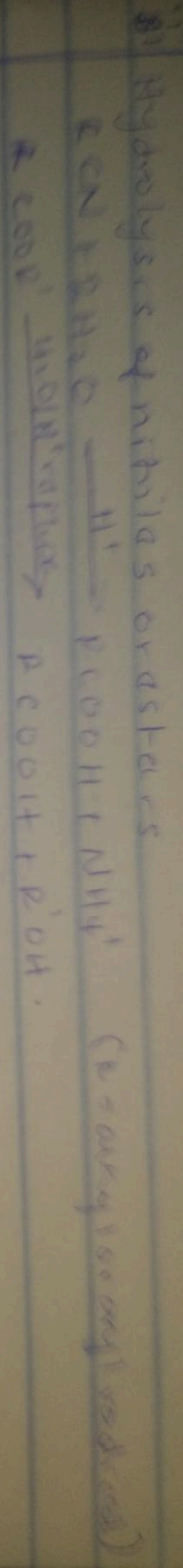
ii) Carbonation of Grignard reagent: Aliphatic carboxylic acids are obtained by bubbling CO<sub>2</sub> into Grignard reagent and then hydrolyzed with dilute acid



In the preparation of benzoic acid, the reagent is added to solid CO<sub>2</sub> which also serves as a coolant for the mixture

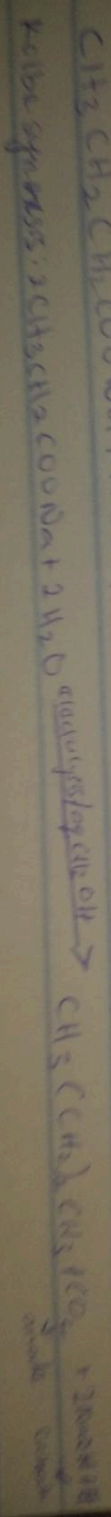
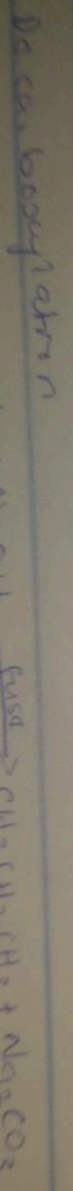
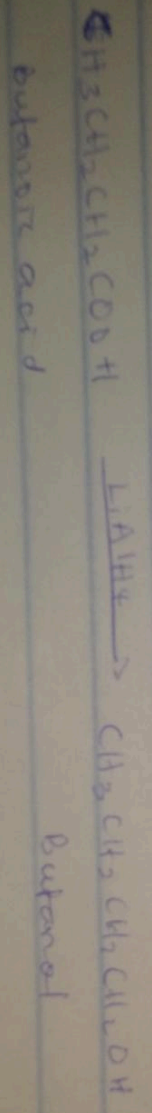
$$C_6H_5MgBr + CO_2 \xrightarrow{(C_2H_5)_2O} C_6H_5COOMgBr \xrightarrow{H_2O / H^+} C_6H_5COOH + MgBrOH$$






3 With chemical equations only, outline the reduction, decarboxylation, and esterification of acetic acid.

Reduction:



Estification

