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COURSE CODE: CHM 102
LEVEL: 100

Assignment

1. Give the IUPAC names of the following compounds
- 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
 - $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ — 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:

All simple aliphatic carboxylic acids up to C_{10} are liquids 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 the room temperature.

ii) Boiling points:

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

iii) Solubility:

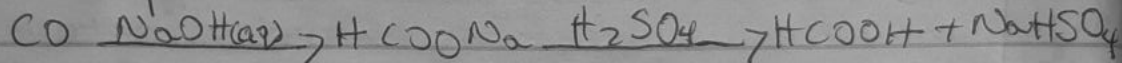
Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water, this largely due to their ability to form hydrogen bonds with water.

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.

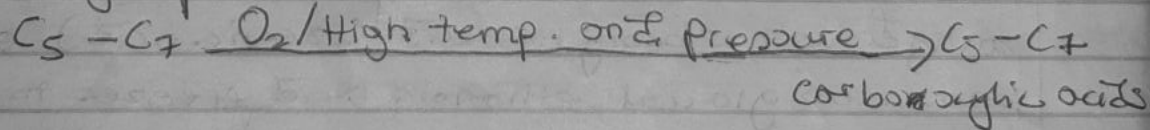
a) From Carbon (II) oxide

Methanoic acid (formic acid) is manufactured by adding carbon(II)oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate (VI) acid (H_2SO_4)



b) From Petroleum

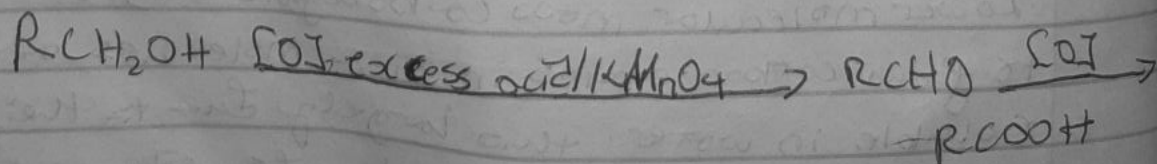
Liquid phase air oxidation of $C_5 - C_7$ alkanes, obtainable from petroleum at high temperature and pressure will give $C_5 - C_7$ carboxylic acids with methanoic, propanoic and butanedioic acids as by-products.



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

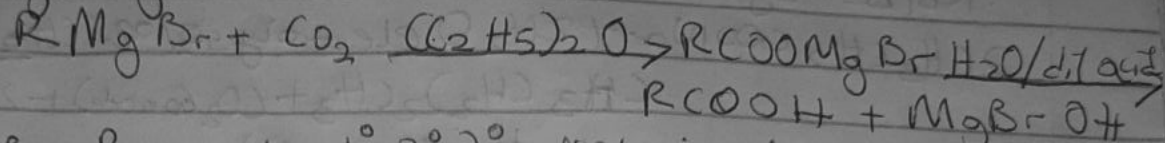
a) Oxidation of primary alcohols and aldehydes

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (i.e. $K_2Cr_2O_7$ or $KMnO_4$) in acidic solution.

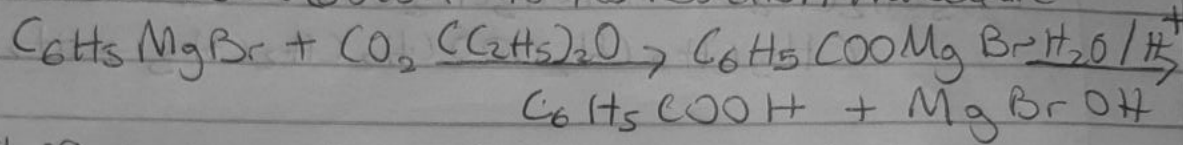


b) Carbonation of Grignard reagent

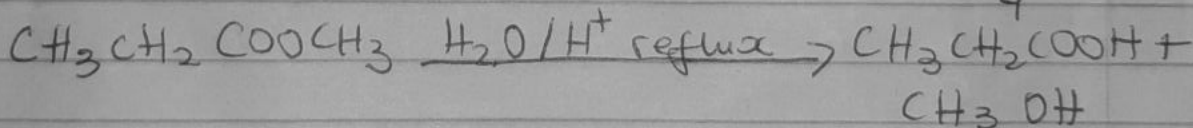
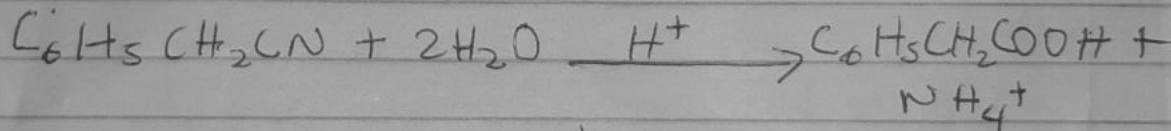
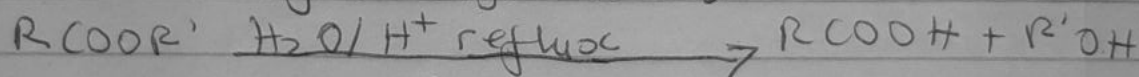
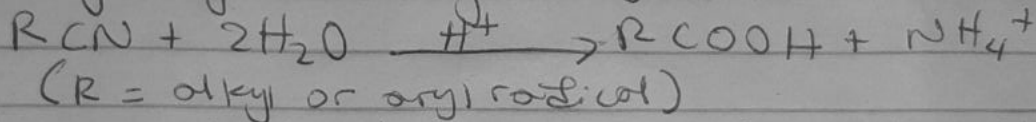
Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid



for R may be 1°, 2°, 3° aliphatic alkyl or aryl radical
In preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as solvent to the reaction mixture

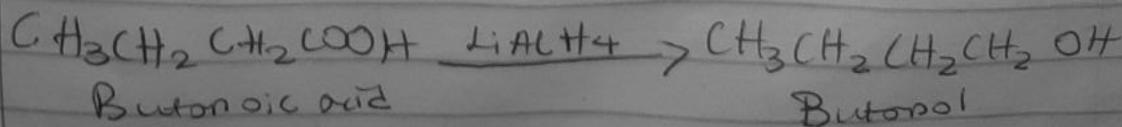
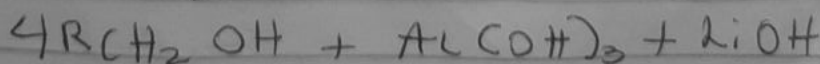
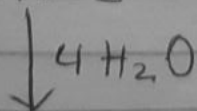
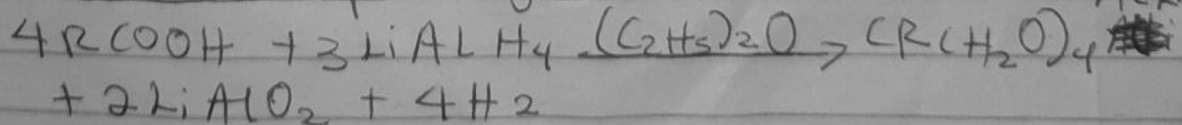


c) Hydrolysis of nitriles (cyanides) or esters

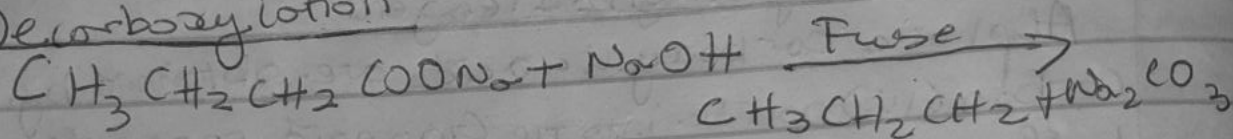


5. Write the chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

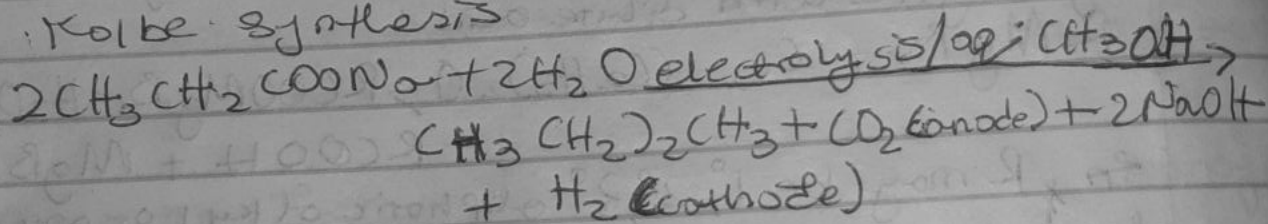
a) Reduction to primary alcohol



b) Decarboxylation



• Kolbe synthesis



c) Esterification

