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Department: Nursing Sciences

College: Medicine & Health Sciences

Course Code: GNM 102

1 IUPAC Names

- 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
- $\text{CH}_3(\text{C}_6\text{H}_5)_4\text{COOH}$ - tetranoic acid
- $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - hex-4-enoic acid

2 Physical Properties

a) Physical Appearance

All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxylic acids are solids 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.

b) Boiling point

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

c) Solubility

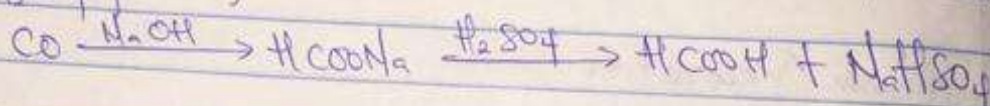
Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water.

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 INDUSTRIAL PREPARATION OF CARBOXYLIC ACIDS

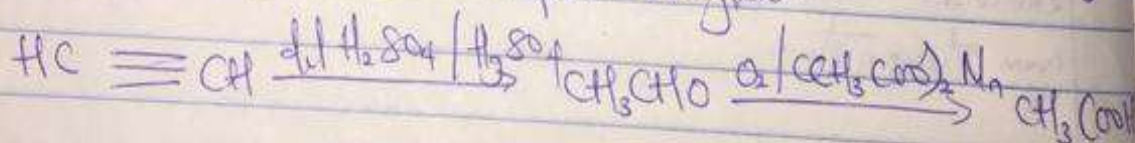
a) From Carbon (II) oxide

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.



b) From Ethanol

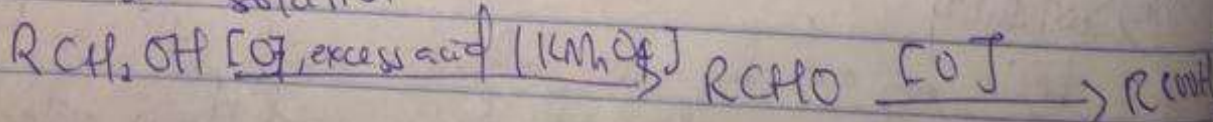
Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using Manganese (II) ethanoate catalyst. Ethanol itself is obtained from ethylene.



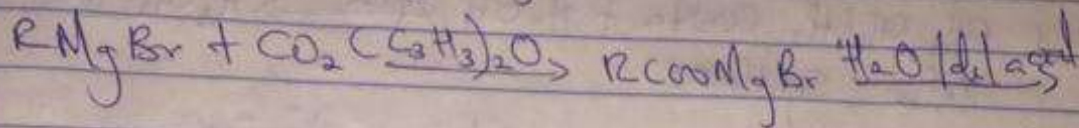
4 SYNTHETIC PREPARATION OF CARBOXYLIC ACIDS

a) Oxidation of primary alcohols and aldehydes

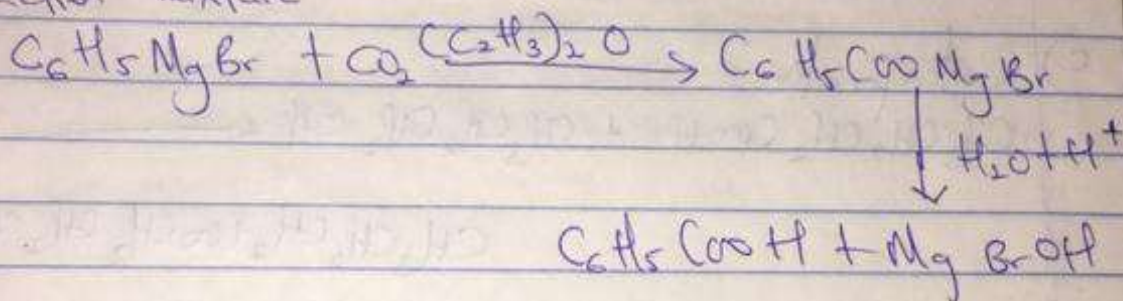
Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents like (i.e. $\text{K}_2\text{Cr}_2\text{O}_7$) or (KMnO_4) in acidic solution.



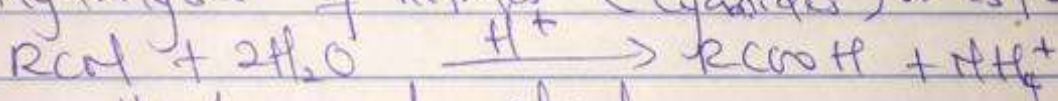
b) Carboxylation of Grignard Reagents:
 Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid.



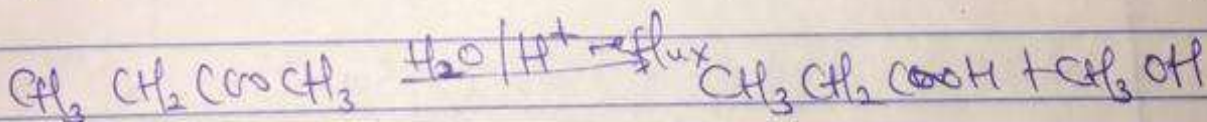
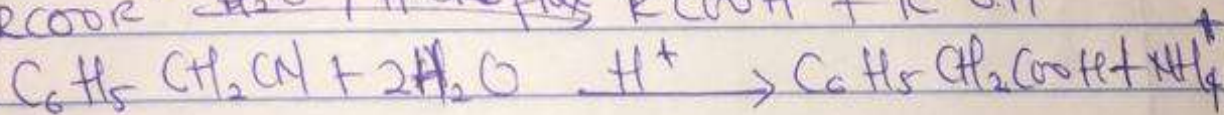
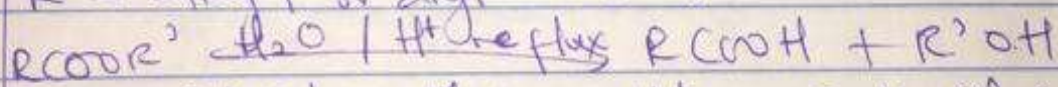
R may be 1°, 2°, 3° aliphatic alkyl or aryl radical in the preparation of benzoic acid the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to the reaction mixture



c) Hydrolysis of nitriles (Cyanides) or esters.

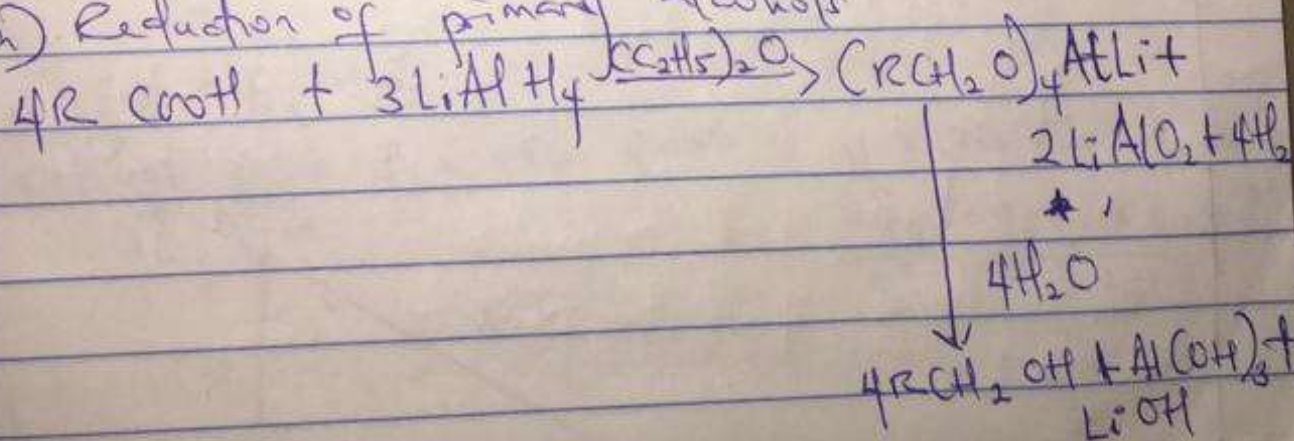


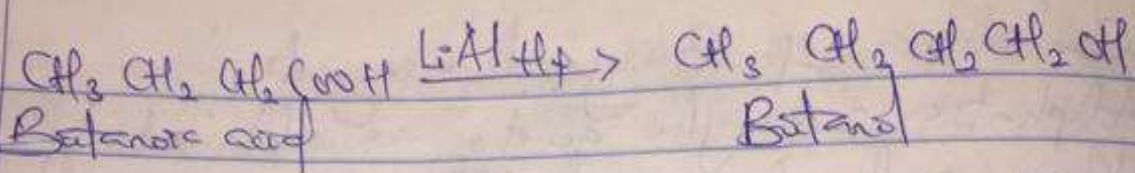
R = alkyl or aryl radical



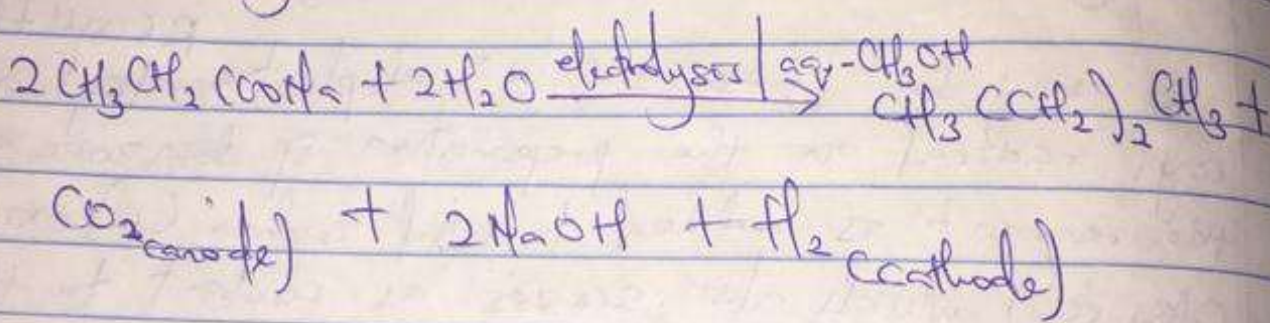
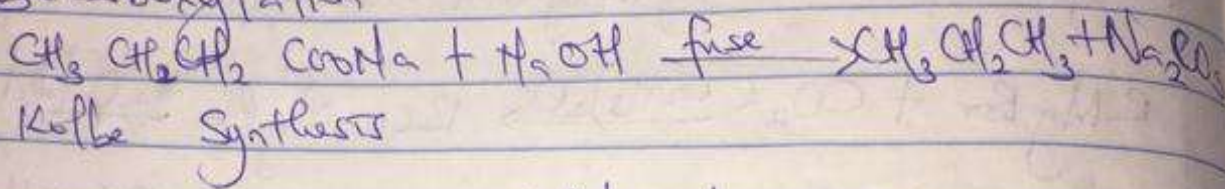
5 CHEMICAL REACTIONS

a) Reduction of primary alcohols

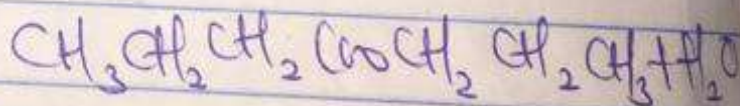
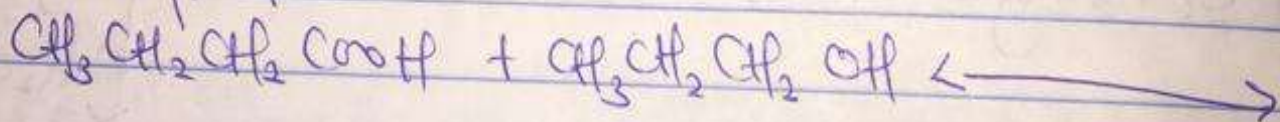




b) Decarboxylation



c) Esterification



Name
Mater
Dip
Car
Ca

2a

2b

(i)