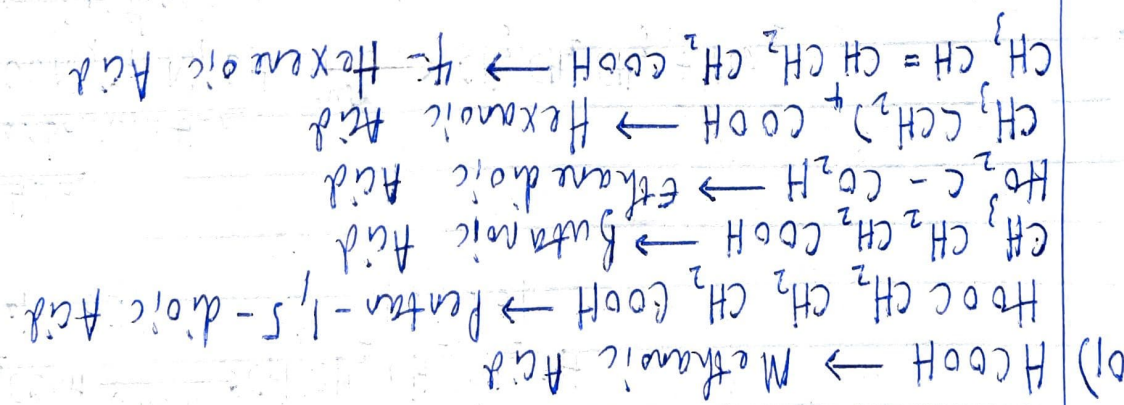


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DEPARTMENT: COMPUTER ENGINEERING

COURSE: MAT CHEM 102 [CARBOXYLIC ACID]

MATR. NO: 191ENG021036



02) Physical Properties

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 temp although anhydrous carboxylic acid (lactic acids) also known as glacial ethanoic acid freeze to an ice-like solid below the room temperature.

Boiling Point

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

Solubility

Lower molecular mass carboxylic acid with up to four carbon atoms in their molecules are soluble in water; this is 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.

03) Industrial Preparations of Carboxylic acids

- 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.

$$\text{CO} \xrightarrow{\text{NaOH}} \text{HCOONa} \xrightarrow{\text{H}_2\text{SO}_4} \text{HCOOH} + \text{NaHSO}_4$$

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.

$$\text{HC} \equiv \text{CH} \xrightarrow{\text{dil. H}_2\text{SO}_4} \text{CH}_3\text{CHO} \xrightarrow{\text{KMnO}_4} \text{CH}_3\text{COOH}$$

Synthetic Preparation of Carboxylic acid

Oxidation of Primary alcohols and aldehydes:

Oxidation of Primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (e.g.  $\text{K}_2\text{Cr}_2\text{O}_7$  or  $\text{KMnO}_4$ ) in acidic solution.

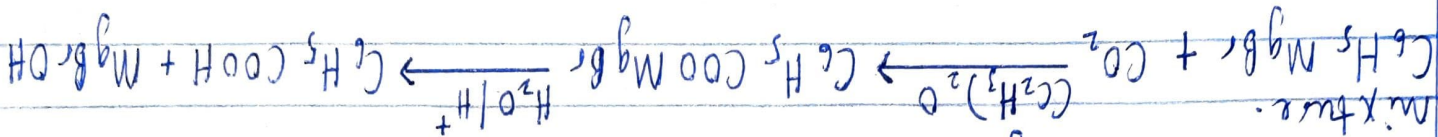


Carbonylation of Grignard Reagent:

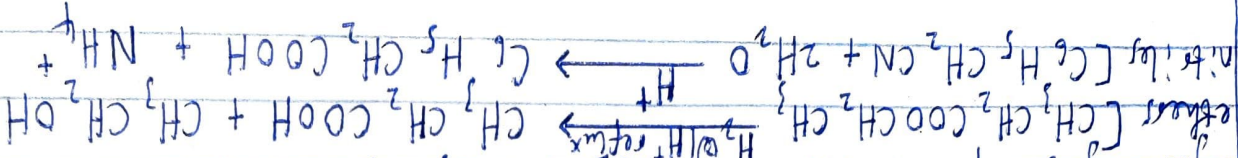
Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide in the Grignard reagent and then hydrolyzed with dilute acid.

$$\text{CH}_3\text{CH}_2\text{CH}_2\text{COO MgBr} + \text{CO}_2 \xrightarrow{\text{C}_2\text{H}_5\text{MgBr}} \text{CH}_3\text{CH}_2\text{CH}_2\text{COO MgBr} \xrightarrow{\text{H}_2\text{O/dil. acid}} \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} + \text{MgBrOH}$$

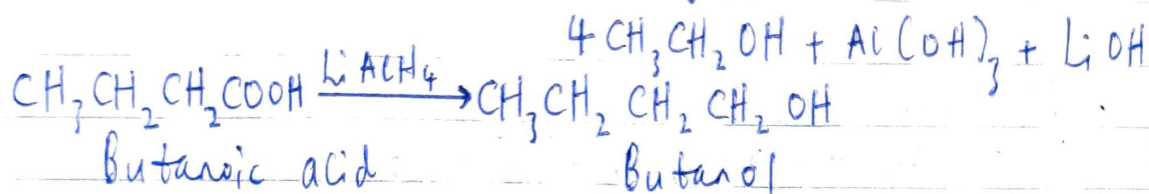
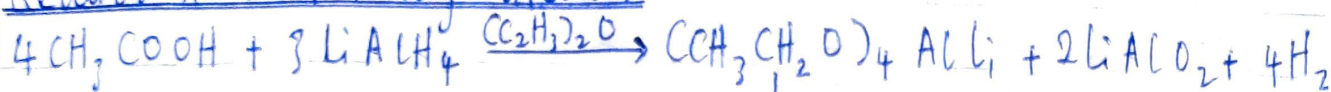
In the preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to the reaction mixture.



Hydrolysis of nitriles (Cyanides) or esters

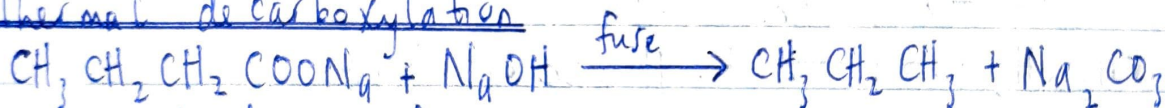


05) Reduction to Primary alcohol

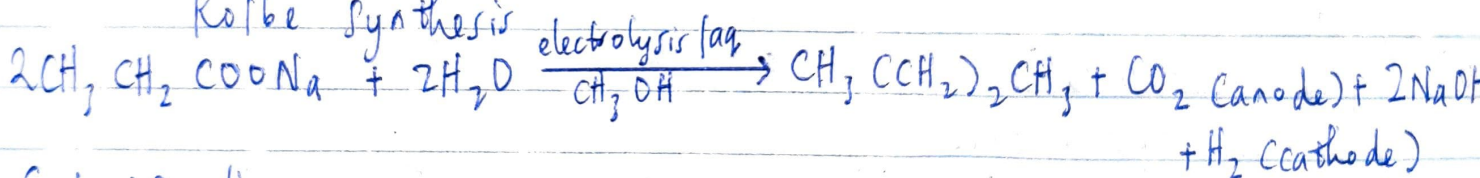


- Decarboxylation

Thermal decarboxylation



Kolbe synthesis



- Esterification

