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CHM102 Assignment on
Carboxylic acid

1. Give the IUPAC name of the following

- i HCOOH - Methanoic acid
- ii $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - Pentan-1,5-dioic acid
- iii $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid
- iv $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - Ethanedioic acid
- v $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid
- vi $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enedic 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 in 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 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.

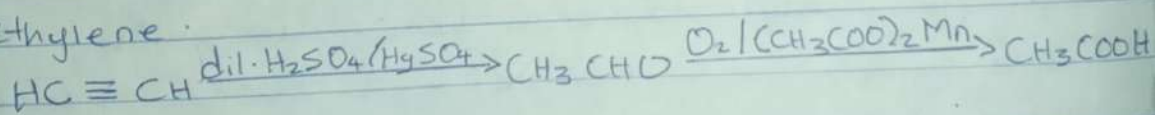
Solubility:-

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

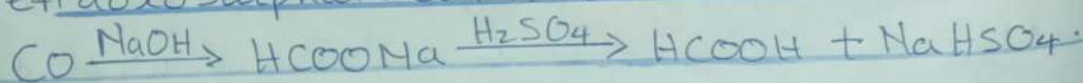
From ethanal

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



From carbon(II)oxide

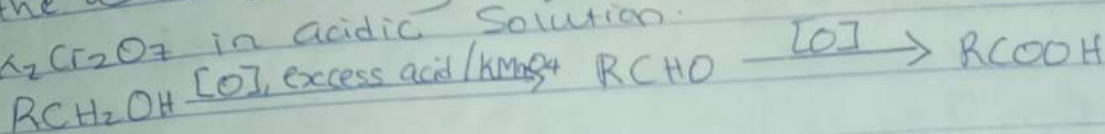
Methanoic acid (Formic acid) is manufactured by adding carbon(II)oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate (VI) acid (H_2SO_4).



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

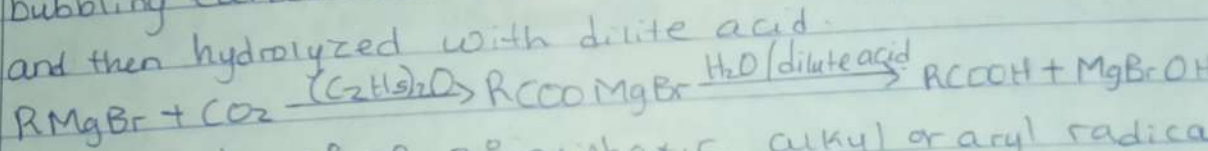
i Preparation through Oxidation of Primary alcohols and Aldehydes:-

Oxidation of Primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents such as KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$ in acidic solution.



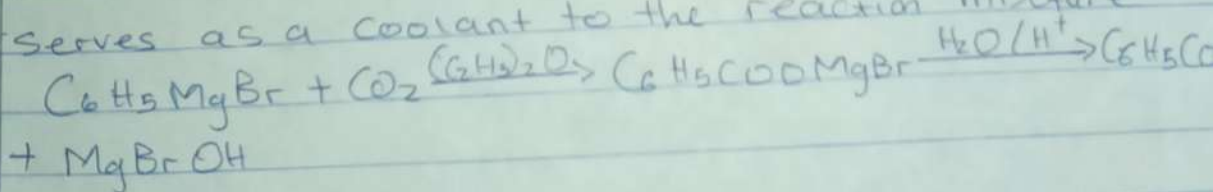
i Preparation with Carbonation of Grignard Reagent

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



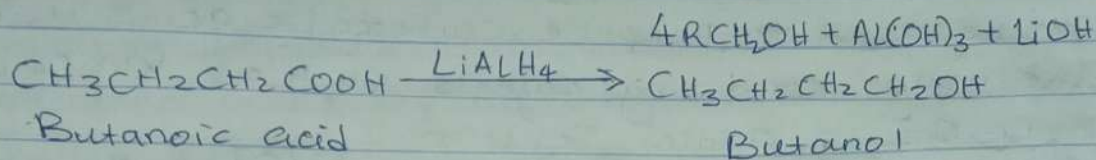
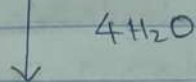
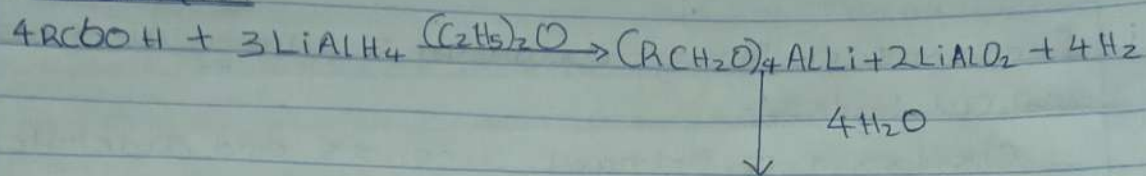
R may be 1° , 2° , 3° aliphatic alkyl or aryl radical.

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



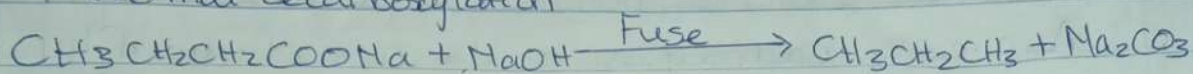
5 With chemical equation only, Outline the reduction, decarboxylation and esterification of carboxylic acid.

I Reduction

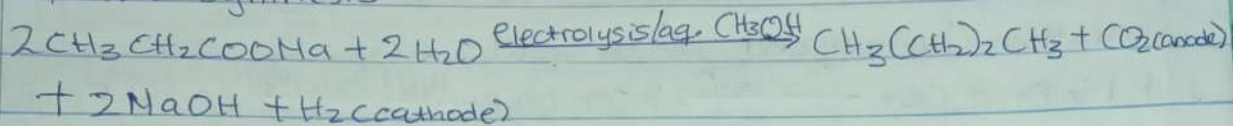


II Decarboxylation

Thermal decarboxylation



Kolbe Synthesis



Esterification

