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MRSE

CHM102

~~Carboxylic Acid~~ Carboxylic Acid

Question

Assignment

1. Give the IUPAC names of the following compounds

- HCOOH - Methanoic Acid

- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic Acid

- $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - Pentan-1,5-dioic

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

- $\text{CH}_3(\text{C}_6\text{H}_5)_4\text{COOH}$ - 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

- Physical Appearance

All simple aliphatic carboxylic acids up to C_{16} 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.

- Boiling Point

Boiling point 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.

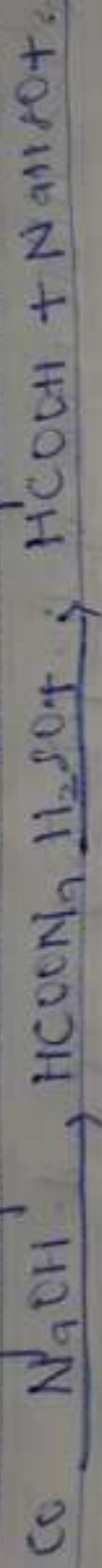
- Solubility

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.

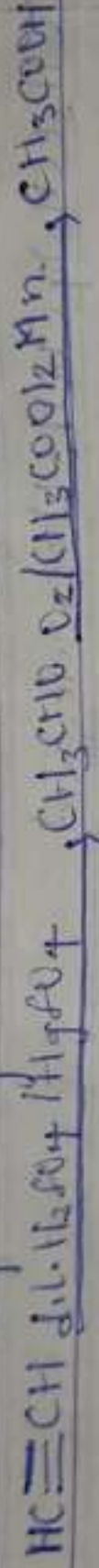
1. From Carbon(II) oxide

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)



2. From Ethanal.

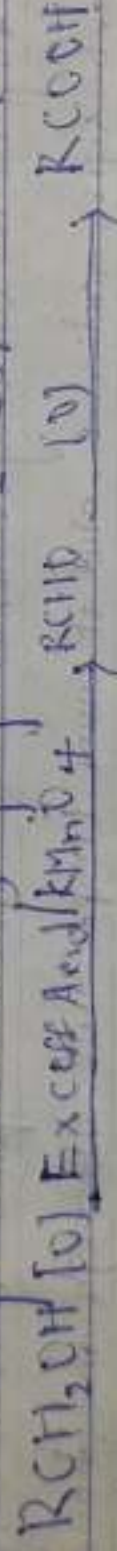
Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanal to ethanoic acid using manganese(II) ethanoate catalyst. Ethanal itself is obtained from ethylene.



4. With equations are brief explanation discuss the synthetic preparation of carboxylic acids.

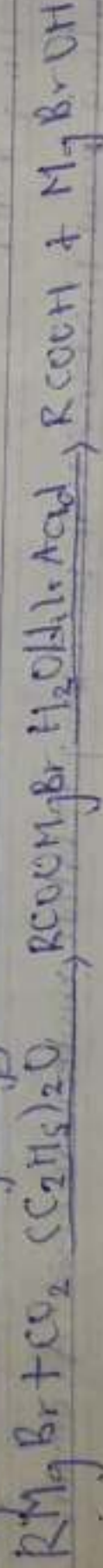
1. Oxidation of primary alcohols & Aldehydes

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



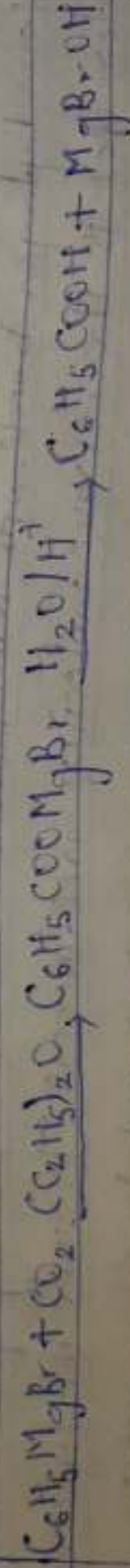
2. Carbonylation of Grignard reagent.

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



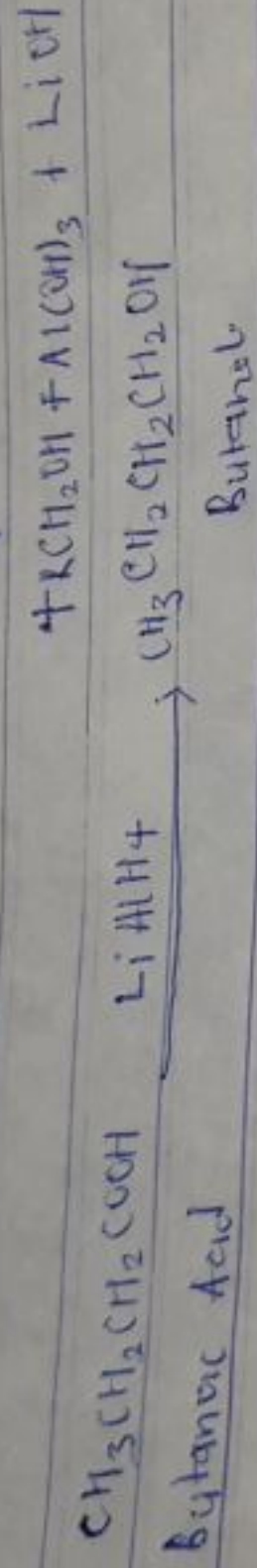
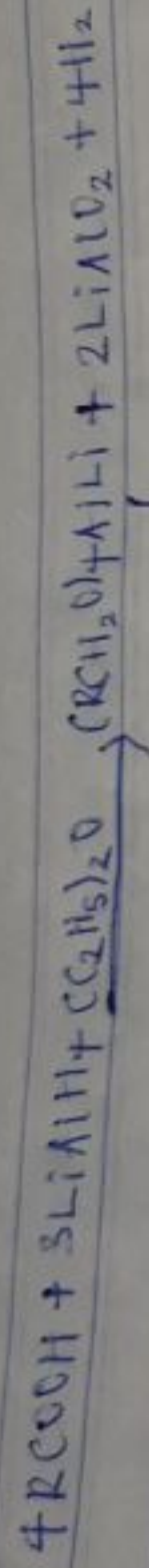
R may be $1^\circ, 2^\circ, 3^\circ$ aliphatic alkyl or vinyl Radical.

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

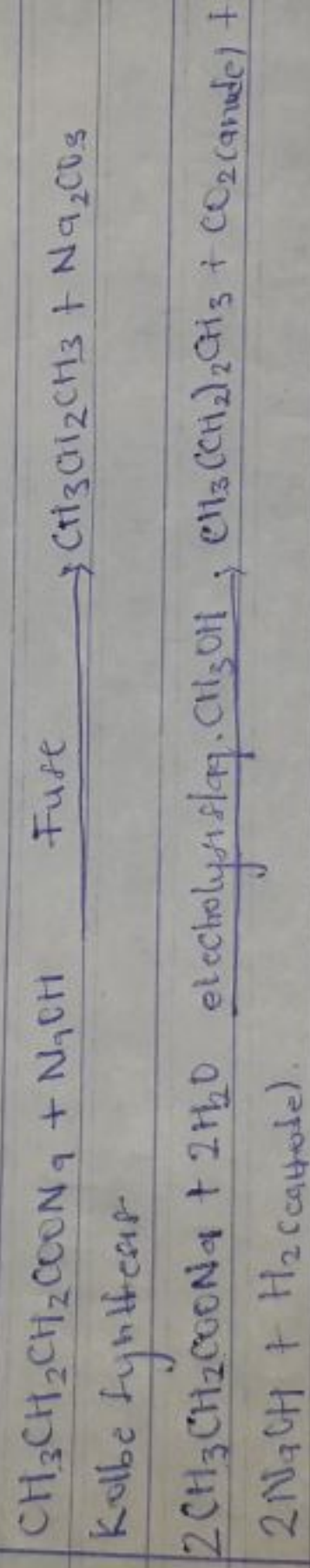


5. Write chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

- Reduction.



- Decarboxylation.



- Esterification.

