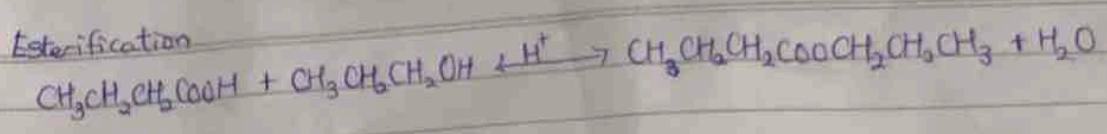


Esterification



ONOKPE SAMUEL OGHEMINE

191ENG03/222

CIVIL ENGINEERING

- $\text{HCOOH}$  - 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.

i) Physical appearance: Carboxylic acids from  $\text{C}_1$  -  $\text{C}_{10}$  are liquids at room temperature. Other carboxylic acids are solid at room temperature apart from anhydrous carboxylic acid (acetic acid) which freezes to an ice-like solid below room temperature.

ii) Boiling point: Boiling point of carboxylic acid increases with molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points.

iii) Solubility: Carboxylic acids with up to 4 carbon atoms are soluble in water because they can form hydrogen bonds <sup>with</sup> water molecules. Its solubility however decreases as the relative molecular mass increases. All carboxylic acids are soluble in organic solvents.

3) Two industrial preparations of carboxylic acids are

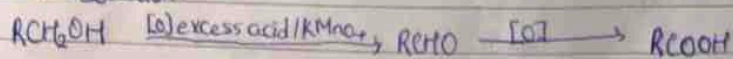
i) From carbon(II)oxide: By adding methanoic acid is formed by adding carbon(II)oxide under pressure to hot aqueous solution of sodium hydroxide. Methanoic acid is liberated by careful reaction with  $\text{H}_2\text{SO}_4$ .

2) From ethanol

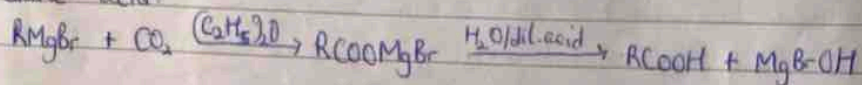
Ethanoic acid is obtained by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganese (II) ethanoate catalyst.

4) Synthetic preparation of carboxylic acids include

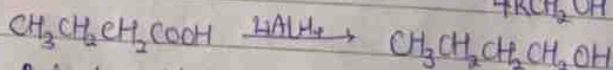
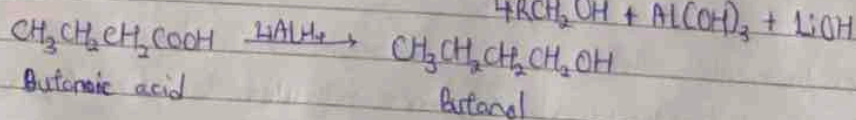
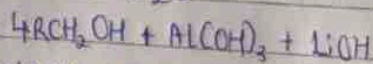
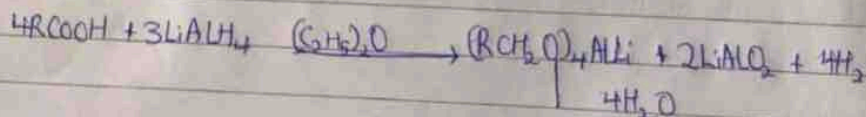
i) Oxidation of primary alcohols and aldehydes: This method can be used to prepare carboxylic acids using the oxidizing agent:  $K_2Cr_2O_7$  or  $KMnO_4$  in acidic solution.



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



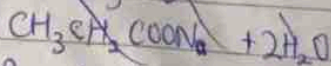
5) Reduction



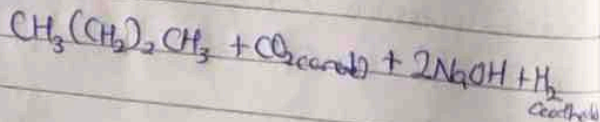
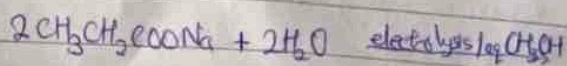
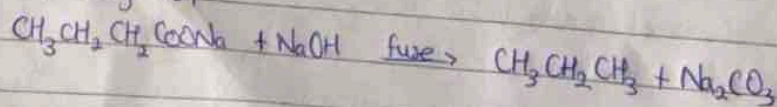
Butanoic acid

Butanol

Decarboxylation



Decarboxylation



Cathode