

Kale-Fadire Elunatunmise Benita

19/11/2011/437

CHM 102

Medicine and Surgery.

1) Give the IUPAC names of the following compounds

- a HCOOH \longrightarrow Methanoic acid
b $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ \longrightarrow Pentan-1,5-dioic acid
c $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ \longrightarrow Butanoic acid
d $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ \longrightarrow Ethanedioic acid
e $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ \longrightarrow Hexanoic acid
f $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ \longrightarrow Hex-4-enoic acid

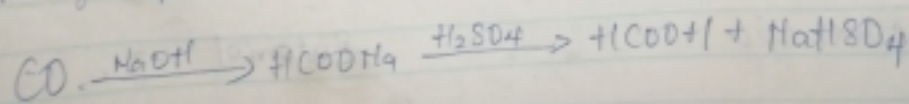
2) Discuss briefly the physical properties of carboxylic acids under the following headings

- i) Physical appearance: All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxylic acids are solid 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.
- ii) Boiling points: 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.
- iii) Solubility: Lower molecular mass carboxylic acids 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.

3) Write two industrial preparations of carboxylic acids

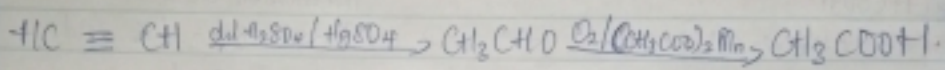
i) From Carbon (C) oxide

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



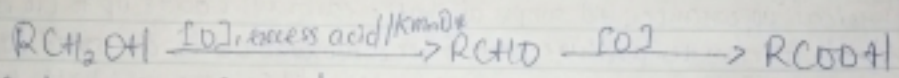
2) From ethanol

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.

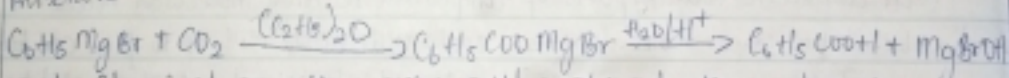


4) With equations and brief explanation discuss the synthetic preparations of carboxylic acids.

i) Oxidation of alcohols and aldehydes: Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidising agents (e.g. $K_2Cr_2O_7$ or $KMnO_4$) in acidic solution

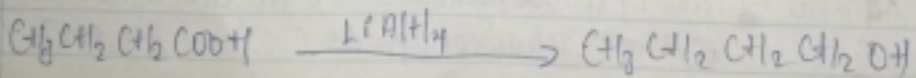
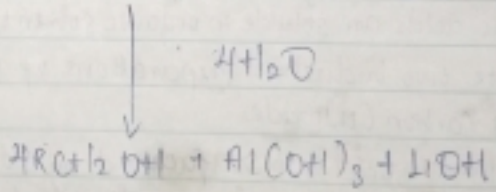
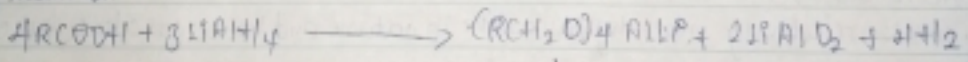


ii) Carboxylation of Grignard reagent: Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard's reagent and then hydrolyzed with dilute acid. In the preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to the reaction mixture.



5) With Chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

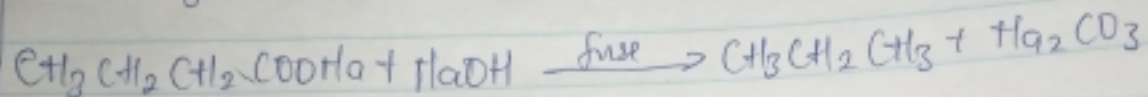
a) Reduction



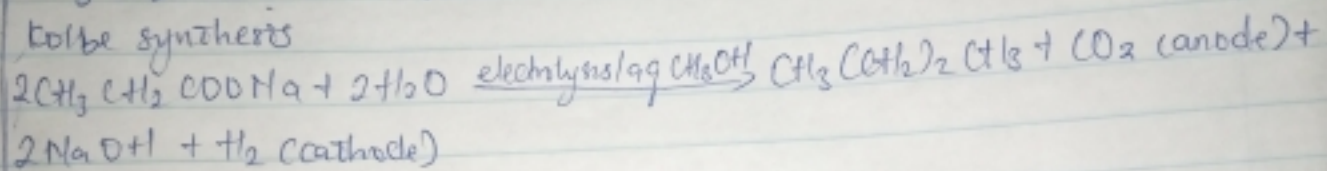
Butanoic acid

Butanol

2) Decarboxylation



Kolbe synthesis



3) Esterification

