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MATRIC NUMBER: 19/MHS01/414

COLLEGE: MEDICINE AND HEALTH SCIENCES

DEPARTMENT: MEDICINE AND SURGERY

COURSE CODE: CHEMISTRY 102

1. Give the IUPAC names of the following compounds (i) HCOOH (ii) HOOCCH₂CH₂CH₂COOH (iii) CH₂CH₂CH₂COOH (iv) HO₂C-CO₂H (v) CH₃(CH₂)₄COOH (vi) CH₃CH=CHCH₂CH₂COOH.

(i) HCOOH- Methanoic acid

(ii) HOOCCH₂CH₂CH₂COOH – Penta-1,5-dioic acid

(iii) CH₂CH₂CH₂COOH- Butanoic acid

(iv) HO₂C-CO₂H- Ethanedioic acid

(v) CH₃(CH₂)₄COOH- Hexanoic acid

(vi) CH₃CH=CHCH₂CH₂COOH- Hex-4-eneoic acid.

2. Discuss briefly the physical properties of carboxylic acid under the following trendings.
(i) physical appearance (ii) boiling point (iii) solubility

physical appearances

All simple aliphatic carboxylic acids up to C₁₀ 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 room temperature.

Boiling point

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

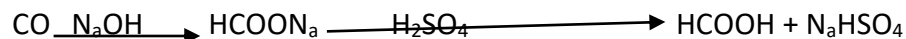
Solubility

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 preparation of carboxylic acid

(i) From carbon(II)oxide

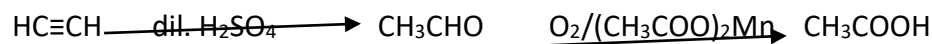
Methanoic acid (formic acid) is manufactured by adding carbon(II)oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate (VI) acid (H₂SO₄).



(ii) From ethanol

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

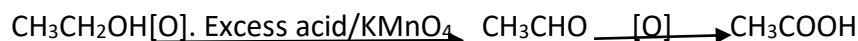
Ethanal itself is obtained from ethylene.



4. With equation and brief explanation discuss the synthetic preparation of carboxylic acid.

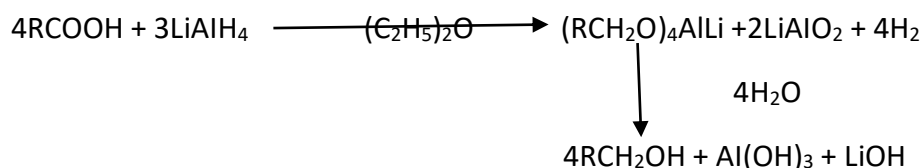
(i) Oxidation of primary alcohols and aldehydes

Oxidation of primary alcohols and aldehydes can only 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.



5. With chemical equation only, outline the reaction, decarboxylation and esterification of carboxylic acid.

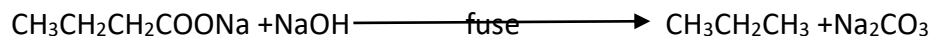
Reduction to primary alcohol



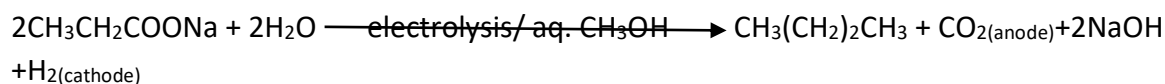
Butanoic acid

butanol

Decarboxylation



Kolbe synthesis



Esterification

