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MATRIC NUMBER: 19/MHS01/315

DEPARTMENT: MEDICINE AND SURGERY

COURSE CODE: CHEMISTRY102

1. Give the IUPAC names of the following compounds

- HCOOH - Methanoic Acid
- $\text{HOOCCH}_2\text{CH}_2\text{COOH}$ - 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

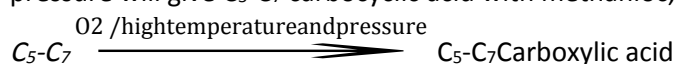
2. Discuss briefly the physical properties of carboxylic acid under the following headings. Physical appearance, Boiling point and Solubility.

- Physical Appearance : All simple carboxylic acid up to C_{10} are liquid 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: This increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solid and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.
- Solubility: Lower molecular mass carboxylic acid with up to four carbon atom in their molecules are soluble in water, this largely due to their ability to form hydrogen bonds with water molecules. The solubility of water decreases as the molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acid are soluble in organic solvents.

3. Write two industrial preparation of carboxylic acids

- From petroleum

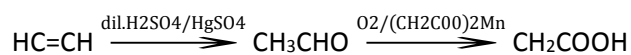
Liquid phase air oxidation of $\text{C}_3\text{-C}_7$ alkane's obtainable from petroleum at high temperature and pressure will give $\text{C}_5\text{-C}_7$ carboxylic acid with methanoic, propanoic and butanoic acid as by-products.



- From ethanol

Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to

ethanoic acid using manganate(ii) ethanoate catalyst. Ethanol itself is obtained from ethylene.



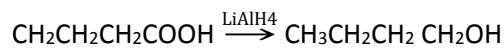
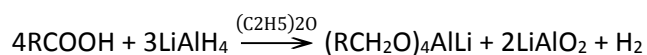
4. With equation and brief explanation discuss the synthetic preparation of carboxylic acid.

- Hydrolysis of nitriles (cyanides) or esters
- $\text{RCN} + 2\text{H}_2\text{O} \xrightarrow{\text{H}^+} \text{RCOOH} + \text{NH}_4^+$
- $\text{RCOOR} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{RCOOH} + \text{R}'\text{OH}$
- $\text{C}_6\text{H}_5\text{CH}_2\text{CN} + 2\text{H}_2\text{O} \xrightarrow{\text{H}^+} \text{C}_6\text{H}_5\text{CH}_2\text{COOH} + \text{NH}_3$
- $\text{CH}_3\text{CH}_2\text{COOCH}_3 \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{CH}_3\text{CH}_2\text{COOH} + \text{CH}_3\text{OH}$

; R = alkyl or aryl radical

5. With chemical equations only outline the reduction, DE carboxylic and esterification of carboxylic acid.

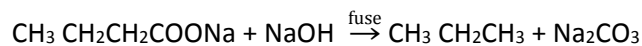
- Reduction



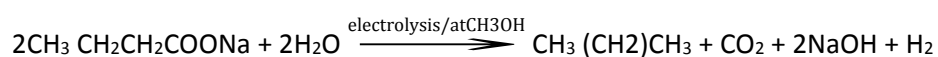
Butanoic acid

Butanol

- DE carboxylic acid



Kallose synthesis



(anode)

(cathode)

- Esterification: $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{H}^+} \text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_3 + \text{H}_2\text{O}$

