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**COURSE CODE: CHM102**

**DEPARTMENT : MEDICINE AND SURGERY**

**MATRIC NO: 19/MHS01/366**

 **ASSIGNMENT**

1)Give the IUPAC names of the following compounds

i)HCOOH: Methanoic acid

ii)HOOCCH2CH2CH2COOH : Pentan-1,5-dioic acid

iii)CH3CH2CH2COOH : Butanoic acid

iv) HO2C-CO2H: Ethan-1,2-dioic acid

v)CH3(CH2)4COOH :Hexanoic acid

vii)CH3CH=CHCH2CH2COOH : Hex-4-eneoic acid

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

1. Physical appearance    ii. Boiling point           iii. Solubility

**PHYSICAL APPERANCE:** All simple aliphatic carboxylic acids up to decanoic acid are liquids at room temperature. Other carboxylic acid are solid at room temperature. However, anhydrous carboxylic such as acetic acid (glacial ethanol acid) freezes to an ice like solid below room temperature. Aromatic carboxylic acid are crystalline solids.

**BOILING POINT :** Boiling point of carboxylic acid increases as the relative molecular mass increases. Aromatic carboxylic acid have higher melting point 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 as a result of their ability to form hydrogen bonds with water molecules. Solubility of carboxylic acids in water decreases as the relative molecular mass increases. This is because the structure contains more hydrocarbon and is now covalent. All carboxylic acids are soluble in organic solvents

3. Write two industrial preparations of carboxylic acids

 Carboxylic acids can be prepared industrially from ethanal, carbon(II) oxide and petroleum.

**FROM** **PETROLEUM :** Liquid phase air oxidation of alkanes having 5 to 7 carbon atom obtainable from petroleum at high temperature and high pressure would produce corresponding carboxylic acid. Methanoic acid, propanoic acid and butanedioic acid as by products

 O2/high temperature and pressure

 CH3CH2CH2CH2CH3 —> CH3CH2CH2CH2COOH

**FROM CARBON(II)OXIDE :** Methanoic acid(formic acid) is produced through this process. Carbon (II) Oxide under pressure is added to hot aqueous solution of sodium hydroxide. A free carboxylic is liberated on careful reaction with tetraoxosulphate (vi) acid (H2SO4)

CO + NaOH —> HCOONa + H2SO4 —> HCOOH + NaHSO4

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

1)**OXIDATION OF PRIMARY ALCOHOLS AND ALDEHYDES :** When primaryalcohols are oxidized, aldehydes are formed and further oxidation of aldehydes yields carboxylic acid. In the oxidation process, oxidizing agents (K2Cr2O7 or KMnO4) in acidic solution is used

 excess acid/KMnO4

CH3CH2OH + [O] —> CH3CHO + [O] —> CH3COOH

2)**CARBONATION OF GRIGNARD REAGENT** : When carbon (IV) oxide is bubbled into Grignard reagent and then hydrolyzed with dilute acid , aliphatic carboxylic acids are formed.

CH3MgBr + CO2 —> CH3COOMgBr ‐—> CH3COOH + MgBrOH (C2H5)2O H2O/ dil. 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

 (C2H5)2O H2O/H+

C6H5MgBr + CO2 —> C6H5COOMgBr —> C6H5COOH + MgBrOH

**3) HYDROLYSIS** **OF** **NITRILES (CYANIDES) OR ESTERS** : Hydrolysis of nitriles (cyanide) or esters.

 H+

C6H5CH2CN + 2H2O ——> C6H5CH2COOH + NH4+

 H2O/H+ reflux

CH3CH2COOCH3 ——> CH3CH2COOH + CH3OH

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

**REDUCTION**

(C2H5)2O

4CH3CH2CH2COOH + 3LiAlH4 ——> (CH3CH2CH2CH2O)4AlLi + 2LiAlO2 + 4H2

 |

 4H2O

 |

 4CH3CH2CH2CH2OH + Al(OH)3 + LiOH

 LiAlH4

CH3CH2CH2COOH ——> CH3CH2CH2CH2OH

Butanoic acid Butanol

**DECARBOXYLATION**

CH3CH2CH2COONa + NaOH —–> CH3CH2CH3 + Na2CO

Kolbe synthesis

 electrolysis/aq. CH3OH

2CH3CH2COONa + 2H2O ——> CH3(CH2)2CH3 +CO2 (anode) + 2NaOH + H2(cathode)

**ESTERIFICATION**

 H+

CH3CH2CH2COOH + CH3CH2CH2OH ——> CH3CH2CH2COO CH2CH2CH3 + H2O.