NAME: OKEREKE MIRACLE ONYINYECHI

MATRIC NUMBER: 19/MHS01/315

DEPARTMENT: MEDICINE AND SURGERY

COURSE CODE: CHEMISTRY102

1.Give the IUPAC names of the following compounds

- HCOOH -Methanoic Acid
- $HOOCCH_2CH_2COOH$ - Pentan-1,5-dioc acid
- $CH_3CH_2CH_2COOH$ - Butanioc acid
- $HO_2C\text{-}CO_2H$ - Ethanedioic acid
- $CH_3(CH_2)_4COOH$ - Hexanoic acid
- $CH_3CH{=}CHCH_2CH_2COOH$ - Hex-4-eneoic 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 freezers to an ice-like solid below the room temperature.
- Boiling point: This increases with increasing relative molecular mass. Aromatic carbon oxylic 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 bounds 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 C_3-C_7 alkane's obtainable from petroleum at high temperature and pressure will give C_5-C_7 carbocyclic acid with methanioc, propanioc and butanioic acid as by-products.

$$C_5\text{-}C_7 \xrightarrow{O2\ /\text{hightemperatureandpressure}} C_5\text{-}C_7\text{Carboxylic acid}$$

- From ethanol

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

ethanioc acid using mongaite(ii) ethanoate catalyst. Ethanol itself is obtained from ethylene.

$$HC{=}CH \xrightarrow{dil.H2SO4/HgSO4} CH_3CHO \xrightarrow{O2/(CH2C00)2Mn} CH_2COOH$$

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

- Hydrolysis of nitrites (cyanides) or esters
- $RCN+2H_2O \xrightarrow{H+} RCOOH + NH_4^+$
- $RCOOR \xrightarrow{H20/Hrefluse} RCOOH + R^3OH$
- $C_6H_3CH_2CN + 2H_2O \xrightarrow{H+} C_6H_5CH_2COOH + NH_3$
- $CH_3CH_2COOCH_3 \xrightarrow{H2O/Hrefluse} CH_3CH_2COOH + CH_3OH$

; R = alkyl or aryl radical

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

- <u>Reduction</u>

$$4RCOOH + 3LiAlH_4 \xrightarrow{(C2H5)2O} (RCH_2O)_4AlLi + 2LiAlO_2 + H_2$$

$$\downarrow 4H_2O$$

$$4RCH_2OH + Al(OH)_3 + LiOH$$

$$CH_2CH_2CH_2COOH \xrightarrow{LiAlH4} CH_3CH_2CH_2\ CH_2OH$$

Butanoic acid Butanol

- <u>DE carboxylic acid</u>

$$CH_3\ CH_2CH_2COONa + NaOH \xrightarrow{fuse} CH_3\ CH_2CH_3 + Na_2CO_3$$

Kallore synthesis

$$2CH_3\ CH_2CH_2COONa + 2H_2O \xrightarrow{electrolysis/atCH3OH} CH_3\ (CH2)CH_3 + CO_2 + 2NaOH + H_2$$

(anode) (cathode)

- <u>Esterification</u>: $CH_3\ CH_2CH_2COOH + CH_3\ CH_2CH_2OH \xleftrightarrow{H+} CH_3\ CH_2CH_2COOCH_2CH_2CH_3 + H_2O$