NAME: ALONGE KEHINDE WURAOLA

MATRIC NO: 19/MHS02/020

COLLEGE: MHS

DEPARTMENT: NURSING SCIENCE

COURSE CODE: CHM 102

1. Give the IUPAC names of the following compounds; $HCOOH, HOOCCH\_{2}CH\_{2}CH\_{2}COOH, CH\_{3}CH\_{2}CH\_{2}COOH, HO\_{2}C-CO\_{2}H$

& $CH\_{3}CH=CHCH\_{2}CH\_{2}COOH.$

ANSWERS

1. $HCOOH-Methanoic acid$
2. $HOOCCH\_{2}CH\_{2}CH\_{2}COOH-Petan-1,5-dioic acid$
3. $CH\_{3}CH\_{2}CH\_{2}COOH-Butanoic acid$
4. $HO\_{2}C-CO\_{2}H-Ethanedioic acid$
5. $CH\_{3}\left(CH\_{2}\right)\_{4}COOH-Hexanoic acid$
6. $CH\_{3}CH=CHCH\_{2}CH\_{2}COOH-Hex-4-eneoic acid.$
7. Discuss briefly the physical properties of carboxylic acids under the following headings; Physical appearance, Boiling point and Solubility

ANSWERS

1. PHYSICAL PROPERTIES

The smaller members of the aliphatic carboxylic acid series are colourless, volatile liquids with strong odours. Large carboxylic acid are solids while anhydrous carboxylic acid (acetic acid) freezes to an ice-like solid below the room temperature. There are many aromatic carboxylic acids, which are all crystalline solids.

1. BOILING POINTS

Carboxylic acids can form intermolecular hydrogen bonds and thus have relatively high melting and boiling points compared to other organic compounds that cannot form hydrogen bonds. The boiling point increases with increasing relative molecular mass. Aromatic carboxylic acid are crystalline solids and have higher melting than their aliphatic counterparts of comparable relative molecular mass.

1. SOLUBILITY

Carboxylic acids with shorter carbon chains are very soluble in water because of their ability to form hydrogen bonds, while those with longer carbon chains are less soluble. Their Solubility in water 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.

1. Write two industrial preparations of carboxylic acids.

ANSWERS

1. From carbon(ii)oxide

Methanoic acid is prepared on a large scale by passing carbon monoxide through aqueous sodium hydroxide solution at 473K under 6-10 atm pressure and distilling the sodium formate (HCOONa) with sulphuric acid.

$$CO+NaOH→HCOONa$$

$$2HCOONa+H\_{2}SO\_{4}→2HCOOH+Na\_{2}S0\_{4}$$

1. From petroleum

Liquid phase air oxidation of$ C\_{5}-C\_{7}$ alkanes, obtainable from petroleum at high temperature and pressure will give $ C\_{5}-C\_{7}$ carboxylic acids with methanoic, propanoic and butanedioic acids as by products.

$$C\_{5}-C\_{7}→C\_{5}-C\_{7} Carboxylic acids$$

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

ANSWERS

1. Oxidation of alcohols

Primary alcohol as undergoes oxidation to produce carboxylic acid on addition of the oxidizing agents. Therefore, the oxidation of primary alcohols produces aldehydes which further repeat the oxidation to produce carboxylic acids. The strong oxidizing agents include potassium permanganate and chromium trioxide can readily oxidize the aldehyde to form carboxylic acids in acidic solution.

$$RCH\_{2}OH→RCHO→RCOOH$$

$$CH\_{3}CH\_{2}OH→CH\_{3}CHO→CH\_{3}COOH$$

 Ethanol Ethanal Ethanoic acid

1. From Grignard reagent

The carboxylic acid formation is possible by Grignard reagents reaction. The reaction of Grignard reagents with crushed dry ice or solid carbon dioxide leads to the formation of salts of carboxylic acid with minerals acids leads to the formation of corresponding carboxylic acids.

$$RMgBr+CO\_{2}→RCOOMgBr→RCOOH+Mg\left(OH\right)Br$$

$C\_{2}H\_{5}MgBr+CO\_{2}→C\_{2}H\_{5}COOMgBr→C\_{2}H\_{5}COOH+Mg\left(OH\right)Br$

1. With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.
2. Reduction of carboxylic acid

$$RCOOH+4\left[H\right]→RCH\_{2}OH+H\_{2}O$$

$$CH\_{3}COOH+4\left[H\right]→CH\_{3}CH\_{2}OH+H\_{2}O$$

1. Decarboxylation of carboxylic acid

$$CH\_{3}COONa+NaOH→CH\_{4}+Na\_{2}CO\_{3}$$

1. Esterification of carboxylic acid

$$CH\_{3}CH\_{2}CH\_{2}COOH+CH\_{3}CH\_{2}CH\_{2}OH↔CH\_{3}CH\_{2}CH\_{2}COOCH\_{2}CH\_{2}CH\_{3}+H\_{2}O$$