NAME: OLUWALE OLUFEMI ADESOLA

COURSE CODE: GST 122

DEPARTMENT: MBBS

MATRIC NUMBER: 19/MHS01/341

NAME: OLUWALE OLUFEMI ADESOLA

DEPT.: MBBS

COURSE CODE: CHEM 102

MATRIC NO.: 19/MHS01/341

1. Give the IUPAC names of the following compounds.

i. $HCOOH$ ⇒ Methanoic acid.

ii. $HOOCCH_2CH_2CH_2COOH$ ⇒ Pentan-1, 5-dioic acid.

iii. $CH_3CH_2CH_2COOH$ ⇒ Butanoic acid.

iv. HO_2C-CO_2H ⇒ Ethanedioic acid.

v. $CH_3(CH_2)_4COOH$ ⇒ Hexanoic acid.

vi. $CH_3CH=CHCH_2CH_2COOH$ ⇒ Hex-4-eneoic acid.

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

i. Physical appearance: All simple aliphatic carboxylic acids up to 10 carbon atoms, C_{10}, are liquids at room temperature. Anhydrous carboxylic acid, also known as acetic acid or glacial ethanoic acid freezes to an ice-like solid ~~below~~ below room temperature. Most other carboxylic acids are solid at room temperature.

ii. Boiling points: As the relative molecular mass increases, so does the boiling point. Aromatic carboxylic acids which are crystalline solids have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

iii. Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water due to their ability to form hydrogen bonds with water molecules. As the acid's covalency increases (the relative molecular mass and hydrocarbon ~~increases and is~~ nature increases), the water solubility of the acid decreases. All carboxylic acids are soluble in organic solvents.

3. Write two industrial preparations of carboxylic acids.

I. From carbon(II)oxide: Methanoic (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.

$CO \xrightarrow{NaOH} HCOONa \xrightarrow{H_2SO_4} HCOOH + NaHSO_4$

Methanoic acid

II. From Ethanol: Ethanoic acid is obtained commercially by the liquid phase air oxidation of 5% solution of Ethanal to Ethanoic acid using Manganite (II) ethanoate catalyst. The Ethanal used is obtained from Ethylene.

$HC \equiv CH \xrightarrow{dil.\ H_2SO_4/HgSO_4} CH_3CHO \xrightarrow{O_2/(CH_3COO)_2Mn} CH_3COOH$

Ethanoic acid.

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

Oxidation of Primary Alcohols and Aldehydes: Carboxylic acids are prepared by oxidizing primary alcohols and aldehydes using oxidizing agents ($K_2Cr_2O_7/KMnO_4$) in an acidic solution.

$CH_3CH_2OH \xrightarrow{[O],\ excess\ acid/KMnO_4} CH_3CHO \xrightarrow{[O]} CH_3COOH$

Ethanol — Ethanal — Ethanoic acid.

5I. Reduction of Carboxylic Acid.

$CH_3CH_2CH_2COOH \xrightarrow{LiAlH_4} CH_3CH_2CH_2CH_2OH$

Butanoic Acid — Butanol

II. Decarboxylation of Carboxylic Acid

5I. Reduction of Carboxylic Acid.

$4CH_3COOH + 3LiAlH_4 \xrightarrow{(C_2H_5)_2O} (CH_3CH_2O)_4AlLi + 2LiAlO_2 + 4H_2 + H_2O$

Ethanoic acid

$4CH_3CH_2OH + Al(OH)_3 + LiOH$

Ethanol

$CH_3CH_2CH_2COOH \xrightarrow{LiAlH_4} CH_3CH_2CH_2CH_2OH$

Butanoic Acid — Butanol

II. Decarboxylation of Carboxylic Acid.

$CH_3CH_2CH_2COONa + NaOH \xrightarrow{fuse} CH_3CH_2CH_3 + Na_2CO_3$

$2CH_3CH_2COONa + 2H_2O \xrightarrow{electrolysis/aq.\ CH_3OH} CH_3(CH_2)_2CH_3 + CO_2\ (anode) + 2NaOH + H_2\ (cathode)$

III. Esterification of Carboxylic Acids.

$$CH_3COOH + C_2H_5OH \xleftrightarrow{H^+} CH_3COOC_2H_5 + H_2O$$

Ethanoic acid Ethanol Ethylethanoate