

NAME: BELLO NIMATH LOLA

MATRIC NO: 19/MHS02/036

DEPARTMENT: NURSING

COURSE CODE: CHEM102 ASS

#### QUESTION 1

Give the IUPAC names of the following compounds.

- $\text{HCOOH}$
- $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{HO}_2\text{C}-\text{CO}_2\text{H}$
- $\text{CH}_3(\text{CH}_2)_4\text{COOH}$
- $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$

#### Answer

- $\text{HCOOH}$  – Methanoic acid
- $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$  – 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- eneoic acid

#### QUESTION 2

Discuss briefly physically properties of carboxylic acids under the following headings

- Physical appearance
- Boiling point
- Solubility

#### Answer

- PHYSICAL APPEARANCE: Simple Aliphatic carboxylic acids that are up to  $\text{C}_{10}$  are liquid at room temperature while 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.

- ii. **BOILING POINT:** The boiling point increases with an increase in relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.
- iii. **SOLUBILITY:** Lower molecular mass of carboxylic acids that are up to four carbon atoms are soluble in water, this is due to their ability to form hydrogen bonds with water molecules. As the relative molecular mass increases the solubility of the acids decreases this is because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

### QUESTION 3

Write two industrial preparations of carboxylic acids.

#### Answer

- i. **From Carbon (II) oxide:** Methanoic acid (formic acid) is manufactured by adding carbon(II)oxide under pressure of hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reactions with tetraoxosulphate(VI)acid ( $H_2SO_4$ )



- ii. **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.

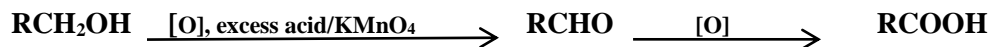


### QUESTION 4

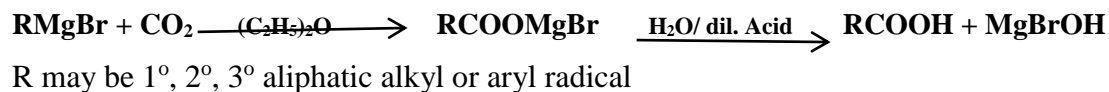
With equations discuss the synthetic preparation of carboxylic acid.

#### Answer

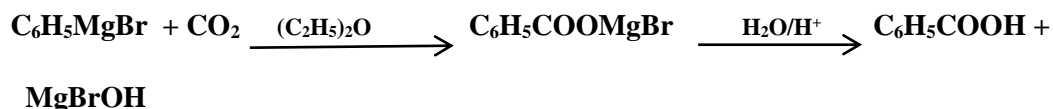
- i. **Oxidation of primary alcohols and aldehydes:** The oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (i.e.  $K_2Cr_2O_7$  or  $KMnO_4$ ) in acidic solution



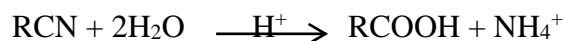
- ii. Carbonation of Grignard reagent: Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid.



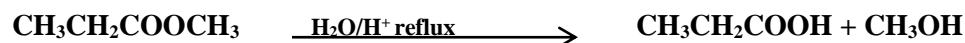
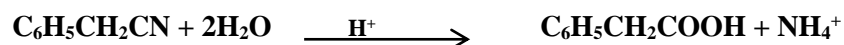
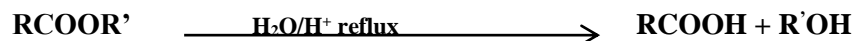
In the preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to the reaction mixture



- iii. Hydrolysis of nitriles (cyanides) or esters



(R=alkyl or aryl radical)

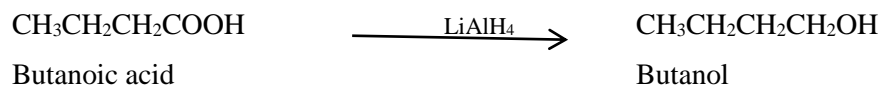
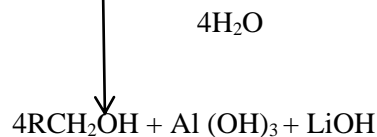
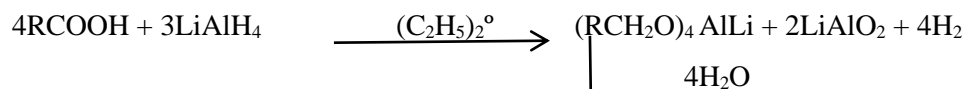


#### QUESTION 5

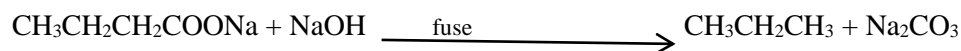
With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

#### Answer

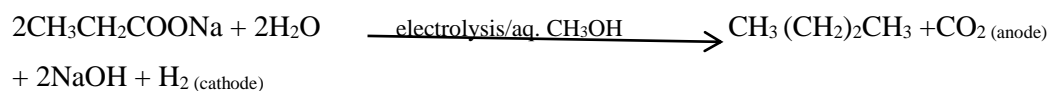
- i. Reduction to primary alcohol



- ii. Decarboxylation



Kolbe synthesis



iii. Esterification

