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MATRIC NUMBER: 19/MHS01/397

DEPARTMENT: MEDICINE AND SURGERY

ASSIGNMENT TITLE: ASSIGNMENT ON CARBOXYLIC ACID

1. Give the IUPAC names of the following compounds

$\text{HCOOH} \rightarrow$  Methanoic acid

$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  Butanoic acid

$\text{CH}_3(\text{CH}_2)_4\text{COOH} \rightarrow$  Hexanoic acid

$\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  Pentane-1,5-dioic acid.

$\text{HO}_2\text{C}-\text{CO}_2\text{H} \rightarrow$  Ethanedioic acid.

$\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH} \rightarrow$  Hex-4-enoic acid

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

(i) Physical appearance: All simple aliphatic carboxylic acids up to  $\text{C}_{10}$  are liquids at room temperature. Most others ~~are~~ 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.

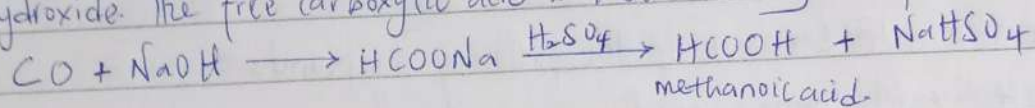
(ii) Boiling points: The boiling point of carboxylic acid increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

(iii) Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water; this is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids 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.

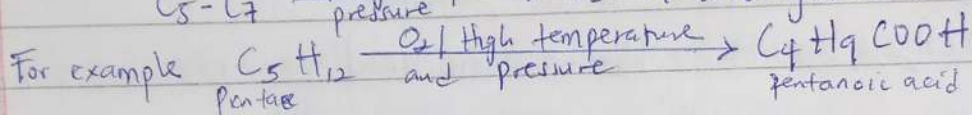
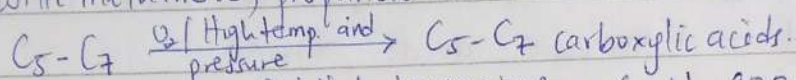
3. Write two industrial preparations of carboxylic acids.

Answer.

1. From Carbon (II) oxide: Methanoic acid (formic acid) is manufactured industrially by adding carbon (II) oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with  $H_2SO_4$ .



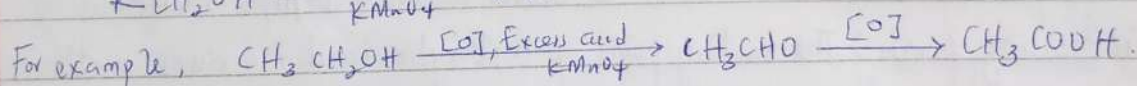
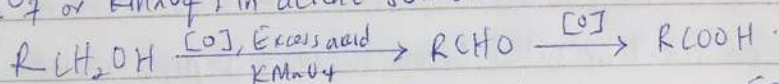
2. From petroleum: Liquid phase air oxidation of  $C_5 - C_7$  alkanes, obtainable from petroleum at high temperature and pressure will give  $C_5 - C_7$  carboxylic acids with methanoic, propanoic and butanedioic acids as by-products.



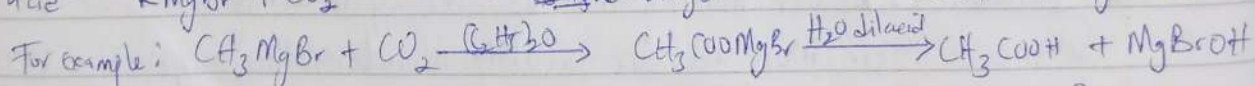
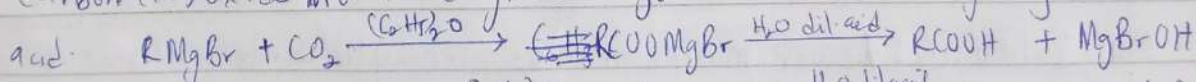
4. With equations and brief explanation, discuss the synthetic preparation of carboxylic acid.

Answer.

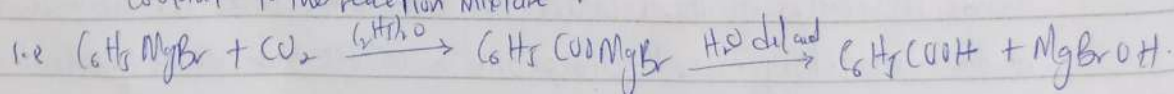
1. Oxidation of primary alcohols and aldehydes: Carboxylic acids can be prepared by oxidizing primary alcohols and aldehydes using the usual oxidizing agents (i.e.  $K_2Cr_2O_7$  or  $KMnO_4$ ) in acidic solution.



2. Carbonylation of Grignard reagent: Aliphatic carboxylic acid are obtained by bubbling Carbon (IV) oxide into the Grignard reagent and it is then hydrolyzed with dilute acid.



Note: In case of benzoic acid, the reagent is added to  $CO_2$  (solid) (dry ice) which serves as coolant to the reaction mixture.



3. Hydrolysis of Nitriles (cyanides) or esters.

