

AFULA EMMANUEL

19/MHS01/048

CHEM102

MBBS

(1) Give the IUPAC names of the following compounds.

- (a) HCOOH (b) $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$
(c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ (d) $\text{HO}_2\text{CCO}_2\text{H}$
(e) $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ (f) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$

(2) Discuss briefly the physical properties of Carboxylic acids under the following headings (i) physical appearances (ii) Boiling point (iii) Solubility.

(3) Write two industrial preparation of Carboxylic acids.

(4) With equations and brief explanation discuss the synthesis preparation of Carboxylic acid

(5) Write chemical equation only, outline the reduction, decarboxylation and esterification of Carboxylic acid.

Answer

(a) Methanoic acid - HCOOH

(b) Pentan-1,5-dioic acid - $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$

(c) Butanoic acid - $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

(d) Ethanedioic acid - $\text{HO}_2\text{CCO}_2\text{H}$

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

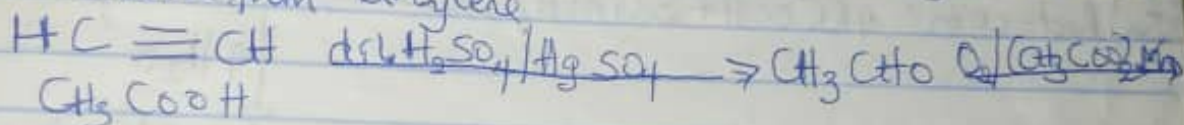
(f) Hex-4-enoic acid - $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$

(2). Physical appearance: All simple aliphatic Carboxylic acids up to C_9 are liquids at room temperature. Most 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.

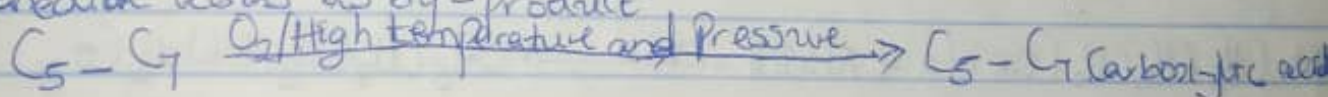
Boiling point: Boiling points increases with increasing relative molecular mass. Aromatic Carboxylic acids are Crystalline Solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

(ii) Solubility: Lower molecular mass Carboxylic acids with up to four carbon atoms in their molecules are soluble in water; this 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 become relatively more hydrocarbon in nature and hence Covalent. All Carboxylic acids are soluble in Organic Solvents.

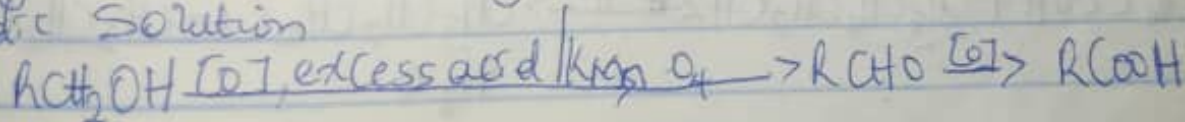
(3) From ethanol: Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganate(II) ethanoate catalyst. Ethanol itself is obtained from ethylene.



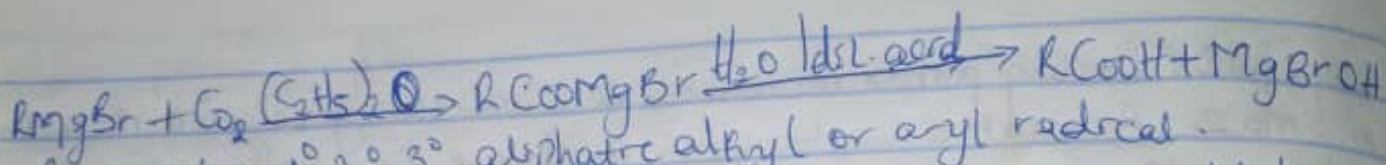
(3) From petroleum: Liquid phase air-oxidation of C₅-C₇ alkanes, obtainable from petroleum at high temperature and pressure will give C₅-C₇ Carboxylic acids with methanoic, propanoic and butanedioic acids as by-product.



(4) Oxidation of primary alcohols and aldehydes: Oxidation of primary alcohols and aldehydes can be used to prepare Carboxylic acids using the usual oxidising agents (i.e. K₂Cr₂O₇ or KMnO₄) in acidic solution.

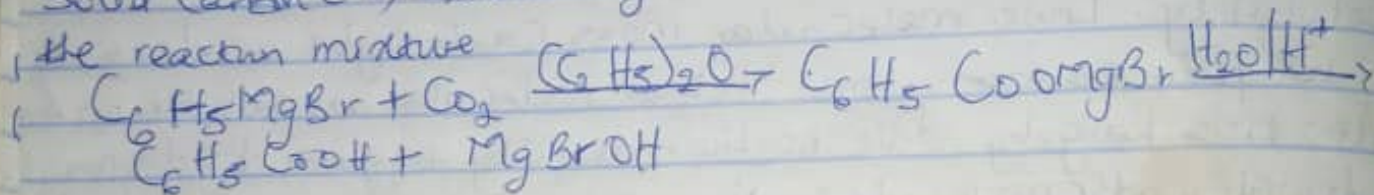


(b) Carbonylation of Grignard reagent: Aliphatic Carboxylic acids are obtained by bubbling Carbon (IV) oxide into the Grignard reagent and then hydrolysed with dilute acid.

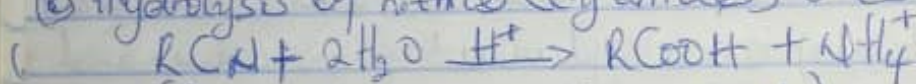


R may be 1°, 2°, 3° aliphatic alkyl or aryl radical.

In the preparation of benzoic acid, the reagent is added to solid carbon (iv) oxide (dry ice) which also serve as coolant to



(a) Hydrolysis of nitriles (Cyanides) or esters



(R = alkyl or aryl radical)

