

# chemistry

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19/MTHSOI/161

MBS

- 1 Give the IUPAC names of the following compounds.

$\text{HCOOH}$  - Methanoic acid

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

$\text{C}_2\text{H}_5\text{CH}_2\text{COOH}$  - Butanoic acid.

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

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

- 2 Discuss briefly the physical properties of Carboxylic acids under the following heading -

i) Physical appearance: All simple ~~Carboxylic~~ aliphatic Carboxylic acids up to  $\text{C}_{10}$  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.

ii) Boiling points: Boiling points increase with increasing relative molecular mass. Aromatic Carboxylic acids are crystalline solids and have higher melting points than

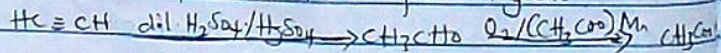
Their aliphatic counterparts of comparable relative molecular mass.

1) 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 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

i) From ethanol:

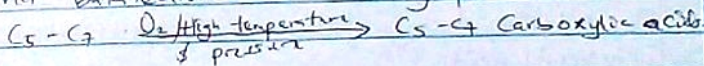
Ethanoic acid obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganate(VII) ethanoate catalyst. Ethanol itself is obtained from ethylene.



ii) From petroleum

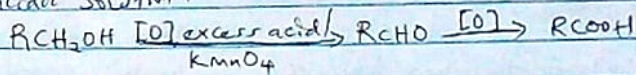
Liquid phase air oxidation of C<sub>5</sub>-C<sub>7</sub> alkanes, obtained from petroleum at high temperature and pressure will give C<sub>5</sub>-C<sub>7</sub> carboxylic acids with methanoic, propanoic

and butenedioic acids as by-products



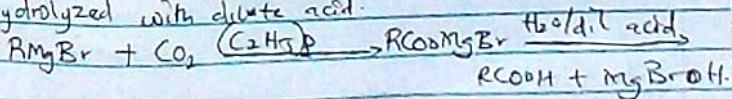
4 With equations and briefs explanation discuss the synthetic preparation of Carboxylic acid.

1 oxidation of primary alcohols and aldehydes.  
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.



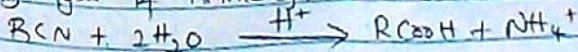
2 Carbonation of Grignard reagent.

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



R may be  $1^\circ, 2^\circ, 3^\circ$ -aliphatic alkyl or aryl radical.

3 Hydrolysis of nitrile (cyanides) or esters.



R = alkyl or aryl radical



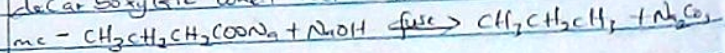
5 with chemical equation only. Outline the outline the reduction, decarboxylation and esterification of Carboxylic acid.

### Decarboxylation.

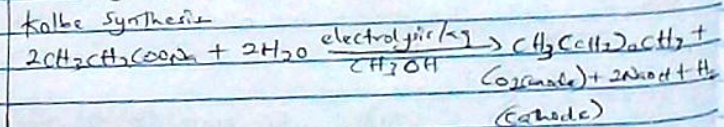
This involves removal of the carboxyl group from the acid to give a hydrocarbon or its derivative.

~~Thermal decomposition~~ decarboxylation.

Carboxylic acid with a strong electron attracting group eg -COOH, -CN, NO<sub>2</sub>, C=O, decarboxylate readily on heating to 100-150°C while others decarboxylate when their salts are heated with soda lime.



Kolbe synthesis



### Esterification

In the presence of strong acid catalyst, Carboxylic acid react with alcohols to form esters.

