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 Course Chem 102
 Dept MBBS
 M/N 19/mhs01/122

1) Give the IUPAC names of the following compounds

a) HCOOH
Methanoic acid or formic acid

b) $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ (5 carbon atoms - Pentane)
 $\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & & & \\ & | & | & | & & & \\ \text{O} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} & \\ & | & | & | & | & & \\ & \text{OH} & \text{H} & \text{H} & \text{H} & \text{O} & \end{array}$ Pentan-1,5-dioic acid

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

d) $\text{HO}_2\text{C}-\text{CO}_2\text{H} = \text{C}_2\text{H}_2\text{O}_4$
Ethanedioic acid (Oxalic acid)

e) $\text{CH}_3(\text{CH}_2)_4\text{COOH}$
 $\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \\ & | & | & | & | & | & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & = \text{O} \\ & | & | & | & | & | & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{O}-\text{H} \end{array}$ Hexanoic acid (6 carbon atoms)

f) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ (Double bond 4th from functional group)
 $\begin{array}{ccccccc} & \text{H} & & \text{H} & \text{H} & \text{H} & \\ & | & & | & | & | & \\ \text{H} & - \text{C} & = \text{C} & - \text{C} & - \text{C} & - \text{C} & = \text{O} \\ & | & & | & | & | & \\ & \text{H} & & \text{H} & \text{H} & \text{OH} & \end{array}$
Hex-4-enoic acid

2) Discuss briefly the physical properties of carboxylic acids i) Headings
 ii) Physical appearance iii) Boiling point iv) Solubility

a) PHYSICAL APPEARANCE

All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most others are solid at room temperature although anhydrous carboxylic acid (acetic acid) known as glacial ethanoic acid

freezes to an ice-like solid below room temperature.

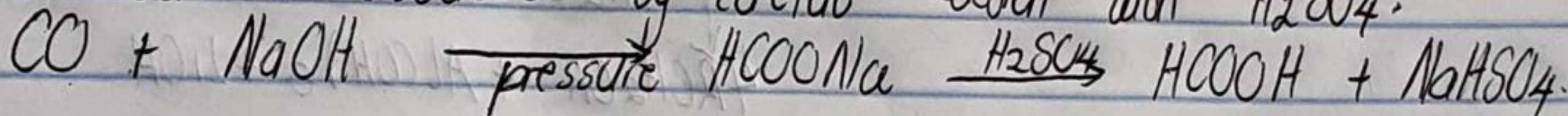
6) BOILING POINTS

It increases with increasing relative molecular mass. Aromatic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

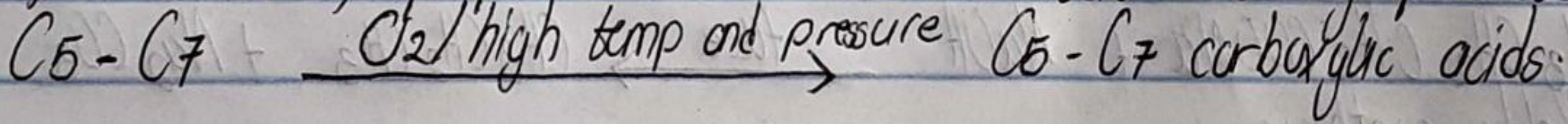
c) SOLUBILITY: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water due to their ability to form hydrogen bonds with water molecules. Solubility decreases as relative molecular mass increases because the structure becomes covalent. All carboxylic acids are soluble in organic solvents.

8) Write two industrial preparations of carboxylic acids

A) From Carbon II oxide: Methanoic acid is manufactured by adding Carbon (II) oxide under pressure to hot aqueous solution of NaOH. The free carboxylic acid is liberated by careful reaction with H_2SO_4 .



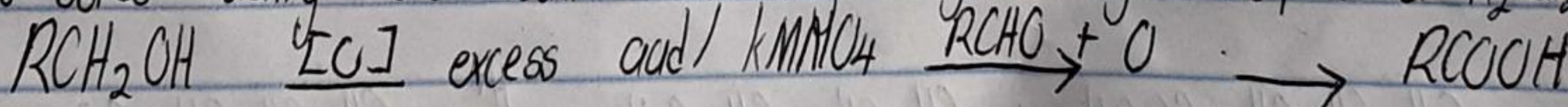
B) From petroleum: Liquid phase air oxidation of C5 - C7 alkanes, obtainable from petroleum at high temperature and pressure will give C5 - C7 carboxylic acids, methanoic, propanoic and butanedioic acid as by products.



4) With equations and brief explanation discuss the synthetic preparations of carboxylic acid.

a) Oxidation of primary alcohols

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidising agents eg $KMnO_4$ etc or $K_2Cr_2O_7$



b) Carboxylation of Grignard reagent:

Aliphatic carboxylic acids are obtained by bubbling CO_2 into Grignard reagent

