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CHEM 102 ASSIGNMENT.

1 Give the IUPAC names of the following compounds

$\text{HCOOH} \Rightarrow$  Methanoic acid

$\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH} \Rightarrow$  Pentan-1,5 dicarboxylic acid.

$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \Rightarrow$  Butanoic 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 -

i) Physical appearance: All simple aliphatic carboxylic acids up to  $\text{C}_6$  are liquids at room temperature. Most other carboxylic acids are solid at room temperature although acetic acid (ethanoic acid) also known as glacial ethanoic acid freezes to an ice like solid below the room temperature.

ii) Boiling point: It 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.

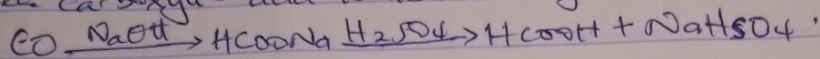
iii) Solubility: Lower molecular mass carboxylic acid carbon atoms in their molecules are soluble in water. This is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and have covalent. All carboxylic acids are soluble in organic solvents.

3 Write two industrial preparations of carboxylic acids.



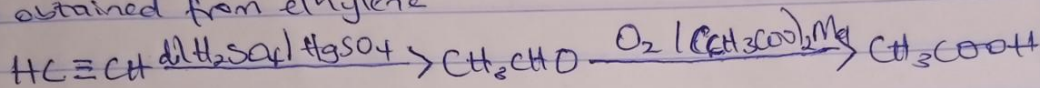
i) From Carbon (II) oxide.

Methanoic acid (formic acid) is manufactured by adding  $\text{CO}$  under pressure to hot aqueous solution of  $\text{NaOH}$ . The free carboxylic acid is liberated by careful reaction with  $\text{H}_2\text{SO}_4$ .



ii) From ethanol

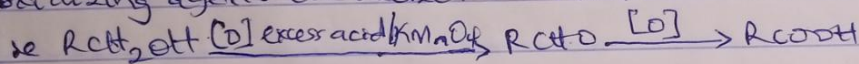
Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanal to ethanoic acid using manganite(II) ethanoate catalyst. Ethanal itself is obtained from ethylene



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

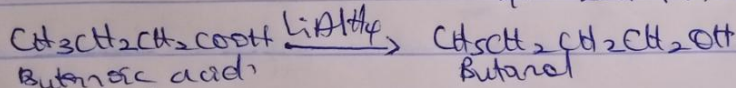
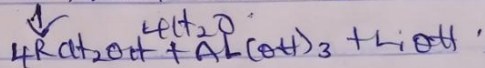
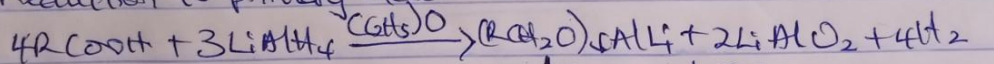
i) Oxidation of primary alcohols and aldehyde

This can be used to prepare carboxylic acids using the usual oxidizing agents (i.e.  $\text{K}_2\text{Cr}_2\text{O}_7$  or  $\text{KMnO}_4$ ) in acidic solution.

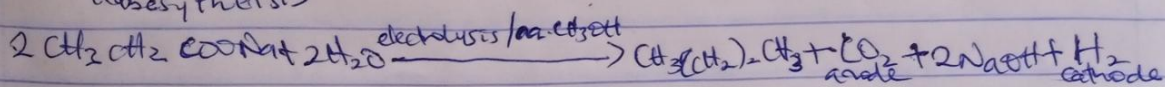
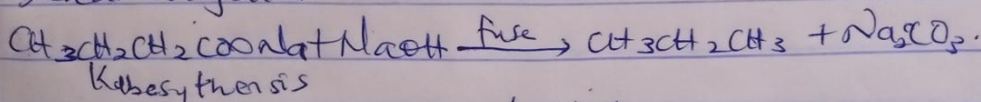


5) With chemical equation only outline the reduction, decarboxylation and esterification of carboxylic acid.

i) Reduction to primary alcohol.



ii) Decarboxylation:



iii) Esterification.

