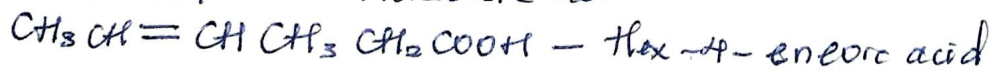
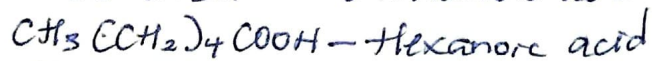
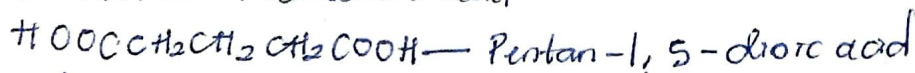
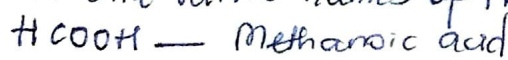


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19/MHS11/030

## CHEM 102 (CARBOXYLIC ACID)

### ASSIGNMENT

1) Give the IUPAC names of the following compounds



2) Discuss briefly the physical properties of carboxylic acids under the following headings: Physical appearance, Boiling point & solubility.

a) Physical appearance - All simple 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.

b) Boiling Point - This 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.

c) 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 2 industrial preparations of carboxylic acids.

a) From Petroleum - liquid phase air oxidation of  $\text{C}_5$ - $\text{C}_7$  alkanes, obtainable from petroleum of high temperature and pressure will give  $\text{C}_5$ - $\text{C}_7$  carboxylic acids with  $\text{CH}_3$  methanoic, propanoic and butanedioic acids as by-products.  
 $\text{C}_5$ - $\text{C}_7$   $\xrightarrow[\text{high temperature and pressure}]{\text{O}_2}$   $\text{C}_5$ - $\text{C}_7$  Carboxylic acid

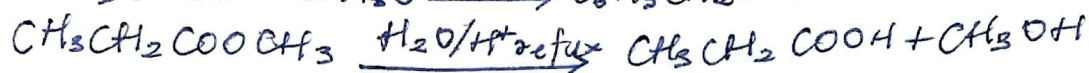
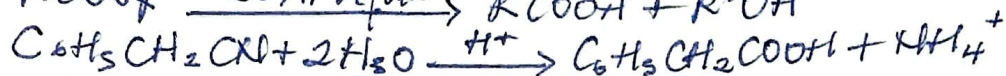
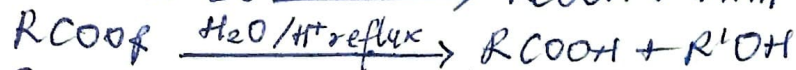
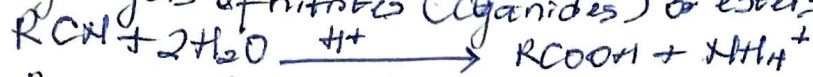
b) From Ethanol - Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganite ( $\text{MnO}$ ) ethanoate catalyst. Ethanal itself is obtained from ethylene.



4) With equations and brief explanations, discuss the synthetic preparation of Carboxylic acid.

Answer

Hydrolysis of nitriles (Cyanides) or esters

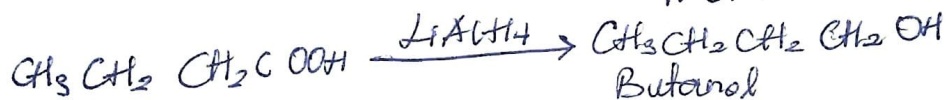
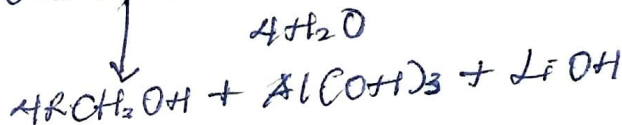


} R = alkyl  
or aryl  
radical

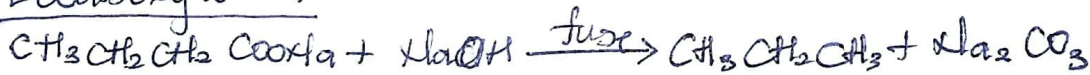
5) With chemical equation only outline the reduction, decarboxylation and esterification of carboxylic acid.

Answer

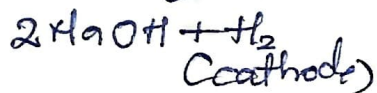
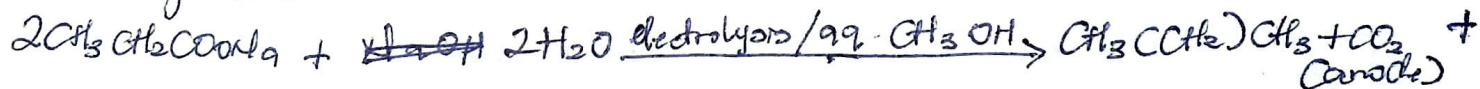
a) Reduction



b) Decarboxylation



Kolbe Synthesis



c) Esterification

