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Course: CEM 102  
Dept: Mechanical  
College: Engineering  
Matric: 19/EN 9051064

① Give the IUPAC name of the following compounds

Answers

- a)  $\text{HCOOH} \rightarrow$  Methanoic acid
- b)  $\text{HCOOC}(\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}) \rightarrow$  Propanoic acid
- c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  Butanoic acid
- d)  $\text{HOOC-COOH} \rightarrow$  Ethanedioic acid
- e)  $\text{CH}_3(\text{C}_6\text{H}_4)\text{COOH} \rightarrow$  Hexanoic acid
- f)  $\text{CH}_3\text{CH}=\text{CHCH}_2\text{COOH} \rightarrow$  Hex-5-enoic acid

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

Answer-

(i) Physical appearance: All simple aliphatic carboxylic acids up to  $\text{C}_{10}$  are liquids at room temperature although acetic acid (ethanoic acid) also known as glacial ethanoic



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 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 hence covalent. All carboxylic acids are soluble in organic solvents.

3) Write two industrial preparations of carboxylic acids

Answer:  
a) From Petroleum:-

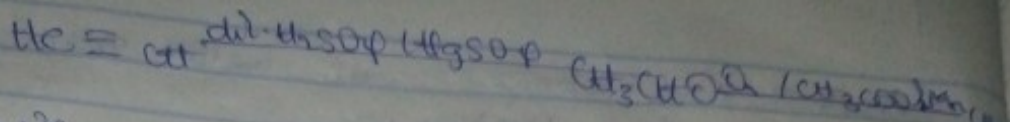
liquid phase air oxidation of C<sub>5</sub>-C<sub>7</sub> alkanes, obtainable from petroleum at high temperature and pressure will give C<sub>5</sub>-C<sub>7</sub> carboxylic acids like methanoic, propanoic and butanedioic acids as by products.

C<sub>5</sub>/C<sub>7</sub>  $\xrightarrow{\text{O}_2/\text{high temperature and pressure}}$  C<sub>5</sub>/C<sub>7</sub> carboxylic acids

b) From Ethanol:

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

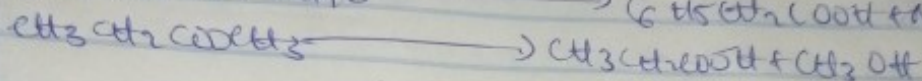
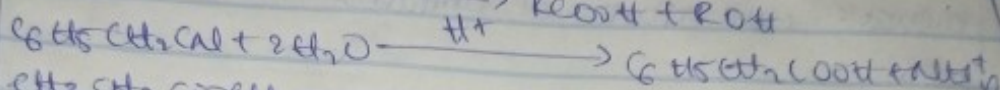
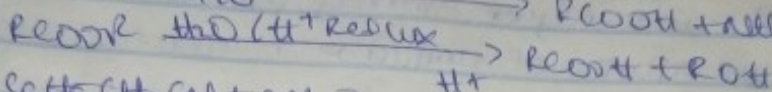
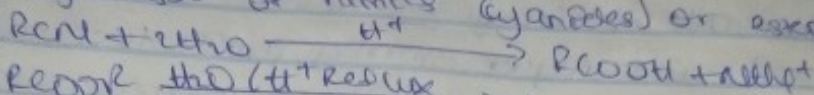




(4) with equations and brief explanation, discuss the synthesis/preparation of carboxylic acids.

Answer:

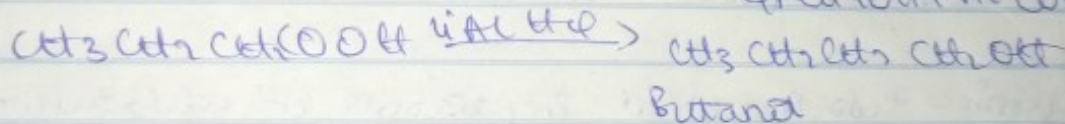
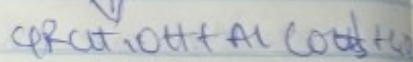
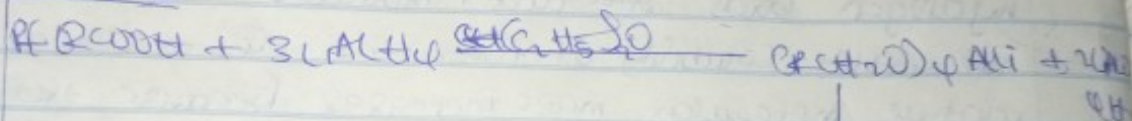
→ Hydrolysis of nitriles (cyanides) or esters



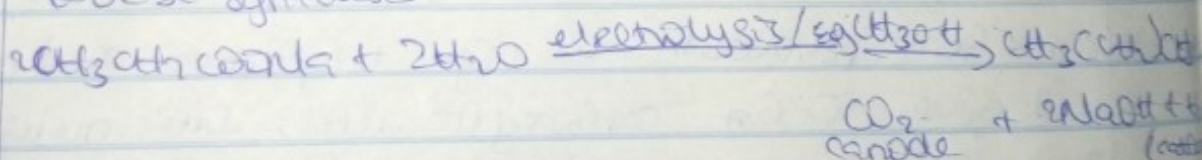
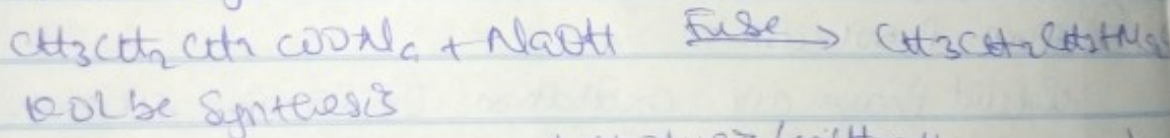
(5) with chemical equation only outline the reduction of carboxylic acid and esterification of carboxylic acid

Answer:

(a) Reduction



(b) Decarboxylation



(c) Esterification

