

Carboxylic Compounds

CHM 102

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Matric No: Department: 19/MATSC/1234 (1000)

- 1) Give the IUPAC names of the following compounds
- $\text{HCOOH} \longrightarrow$ Methanoic acid
 - $\text{HOOCCH}_2\text{CH}_2\text{COOH} \longrightarrow$ Pentane-1,5-dioic acid
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \longrightarrow$ Butanoic acid
 - $\text{H}_2\text{C}=\text{CO}_2\text{H} \longrightarrow$ Ethanedioic acid
 - $\text{CH}_3(\text{CH}_2)_4\text{COOH} \longrightarrow$ Hexanoic acid
 - $\text{CH}_3\text{CH}=\text{CHCH}_2\text{COOH} \longrightarrow$ 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 C_{10} are liquids at room temperatures. Most else aliphatic 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 room temperature.

(2) Boiling point

This increases with increasing ^{chain}molecular mass.

Aromatic carboxylic acids are crystalline solids and have higher melting than their aliphatic counterparts of comparable relative molecular mass.

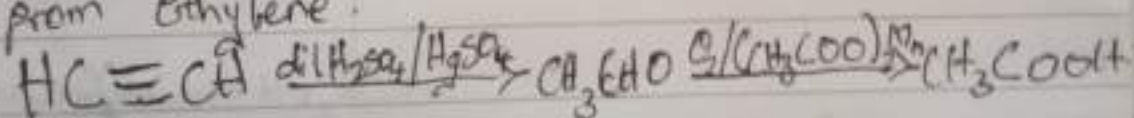
3) Solubility

Lower molecular mass carboxylic acids with up to four carbon atom in their molecules are soluble in water. This is largely due to their ability to form hydrogen bonds with water molecules.

3) Industrial preparation of carboxylic acids

(B) From ethanal

Ethanoic acid is obtained commercially by the liquid phase oxidation of 3% solution of ethanal to ethanoic acid using manganese(II) ethanoate catalyst. Ethanal itself is obtained from ethylene.



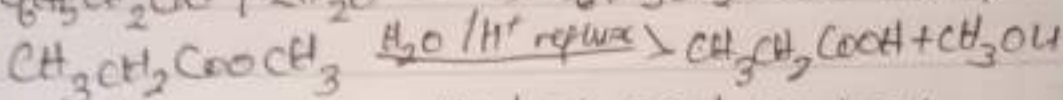
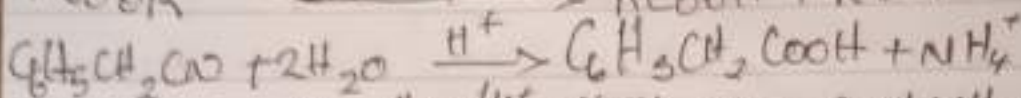
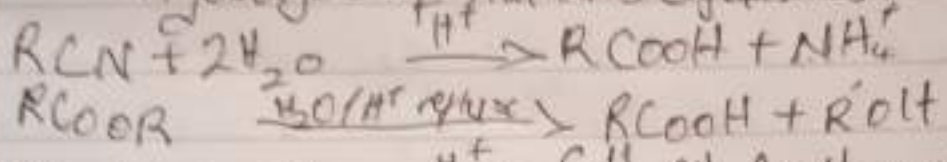
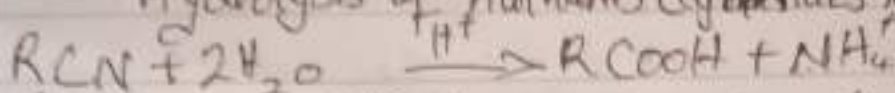
(C) From petroleum

Liquid phase oxidation of C₅-C₇ alkanes obtainable from petroleum at high temperature and pressure will give C₅-C₇ carboxylic acids such as methanoic, propanoic and butanoic acids as by-products.

$C_5 - C_7$ $\xrightarrow[\text{high temp and pressure}]{O_2}$ $C_5 - C_7$ carboxylic acid

A) With equation and brief explanation, discuss the synthetic properties of carboxylic acid.

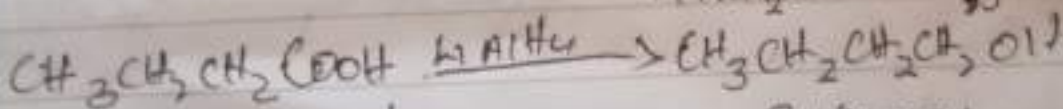
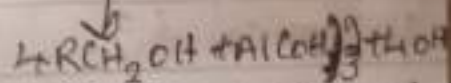
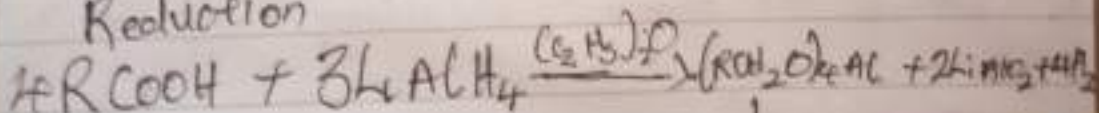
Hydrolysis of nitriles (cyanides) or esters



where R = alkyl or aryl radical.

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

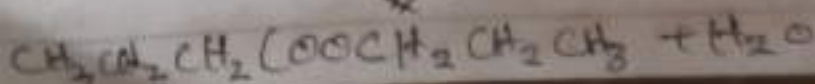
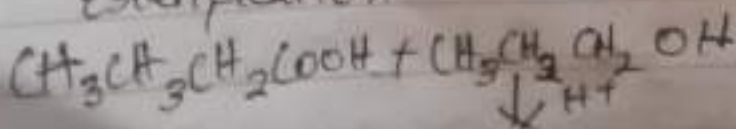
Reduction



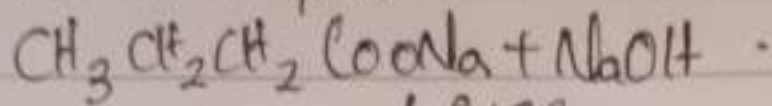
Butanoic acid

Butanol

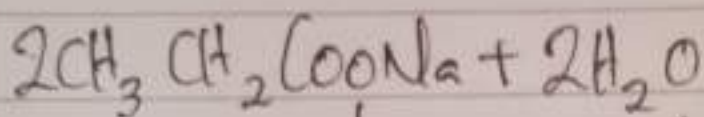
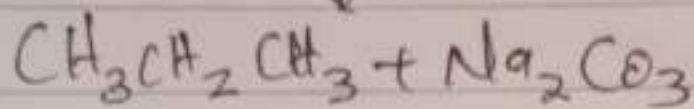
Esterification



Δ Carboxylation



↓ fuse



↓ electrolysis / aq. CH_3OH

