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Matric Number: 19/ENG05/024

Department: Mechatronics Engineering

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- a HCOOH - Methanoic acid
- b $\text{CH}_3\text{CH}_2\text{COOH}$ - Ethanoic acid
- c $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid
- d $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- e $\text{HO}_2\text{C}-\text{CO}_2\text{H}$
- f $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$

2 i Physical appearance:

All simple carboxylic acids are liquids up to C_{10} at room temperature.
Most other carboxylic acids are solid at room temperature.

ii Boiling points:

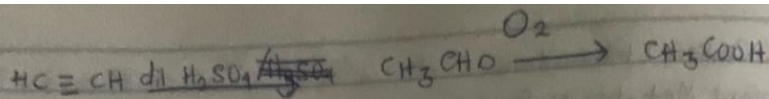
This increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

iii Solubility:

Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water. This is due to their ability to form hydrogen bonds with water molecules. As the relative molecular mass increases, the water solubility reduces because the structure becomes more hydrocarbon.

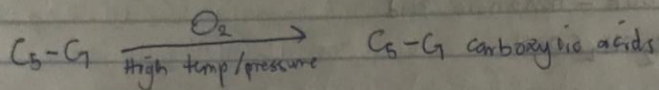
3a From ethanal

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

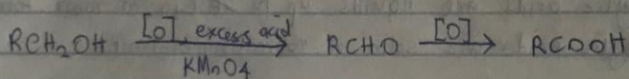


b From petroleum

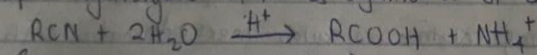
Liquid phase air oxidation of C_5 - C_7 alkanes, obtainable from petroleum at high temperature and pressure will give C_5 - C_7 carboxylic acids with methanoic, propanoic acid and butanoic acids as by-products.



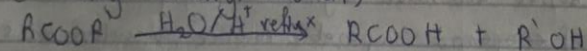
4 Step 1: Oxidation of primary alcohols and aldehydes using oxidizing agents (ie $\text{K}_2\text{Cr}_2\text{O}_7$ or KMnO_4) in acidic solution



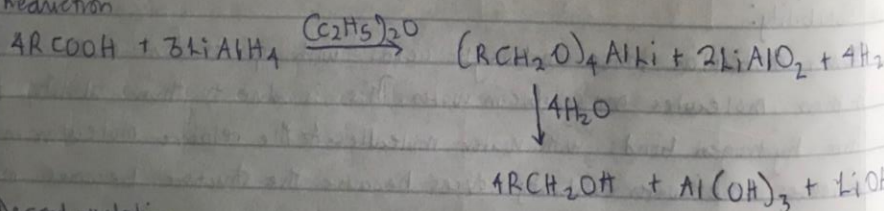
Step 2: Hydrolysis of nitriles (cyanides) or esters



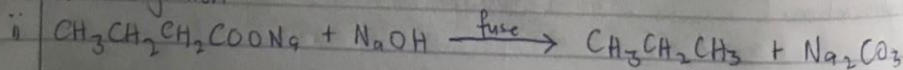
(R = alkyl or aryl radical)



5i Reduction



Decarboxylation



iii Esterification

