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19/SC103/006

Biochemistry

CHM 102

1. HCOOH - Methanoic acid

$\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - Pentan-1,5-dioic acid

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

$\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - Ethanedioic acid

$\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid

$\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enoic acid

2. Physical appearance:

All simple aliphatic carboxylic acid up to C_{10} are liquids at room temperature although most other carboxylic acids are solid at room temp, while anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below room temperature.

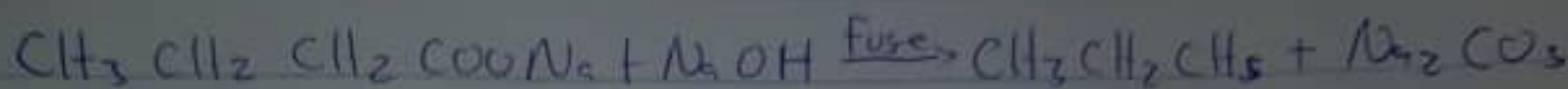
Boiling Points:

Boiling point 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.

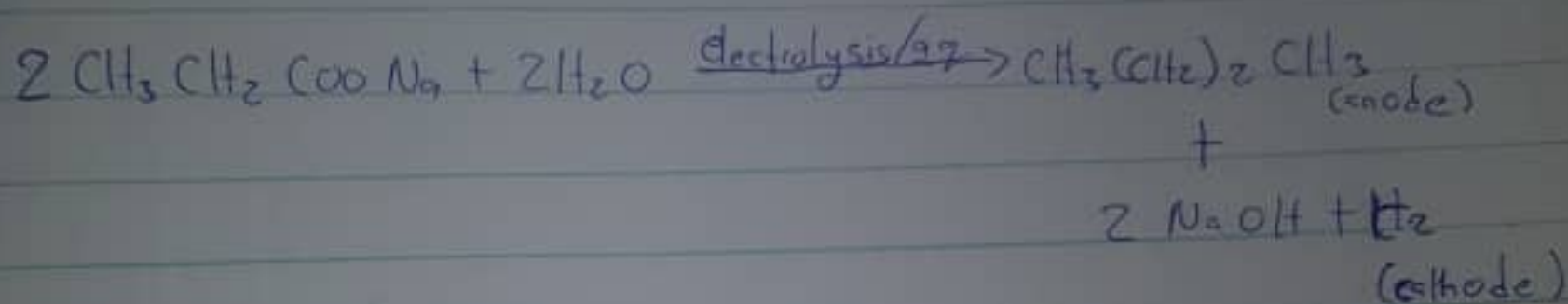
Solubility:

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 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.

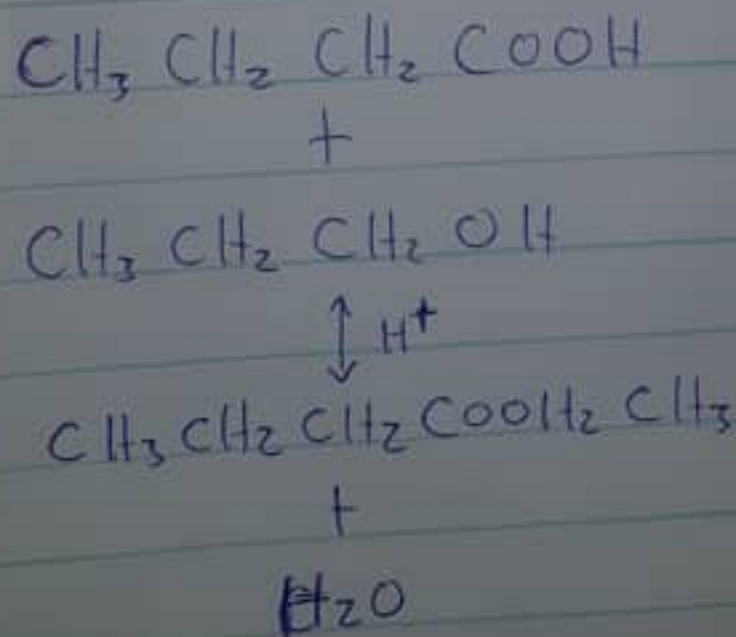
5b Decarboxylation of Carboxylic acid



Kolbe synthesis



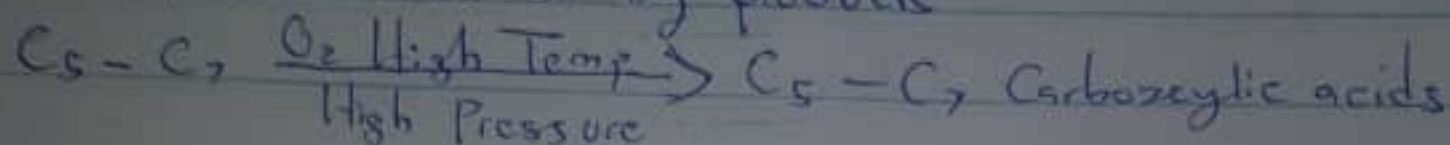
5c Esterification



Industrial Preparation

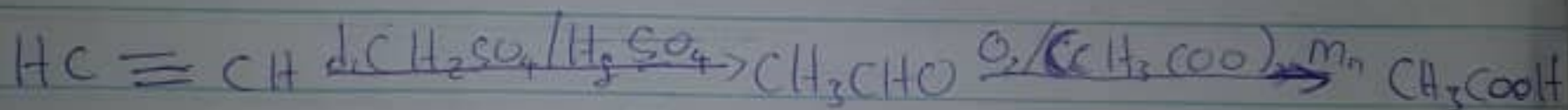
3a From Petroleum

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 and butanoic acids as by products



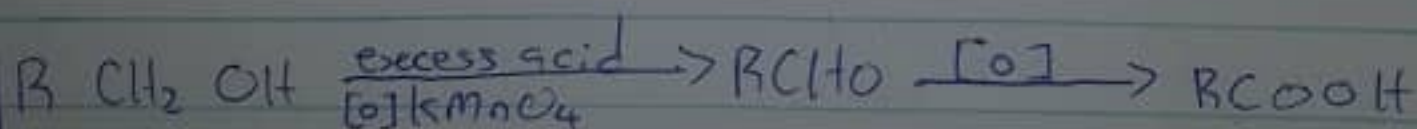
b From Ethanol

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



4 Synthetic Preparation

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents ($K_2Cr_2O_7$ or $KMnO_4$) in acidic solution



5a Reduction of carboxylic acid to primary alcohol

