

Assignment on Carboxylic Acid

- 1) Give the IUPAC names of the following compounds
- HCOOH - Methanoic acid
 - $\text{HOOC(CH}_2\text{)}_4\text{COOH}$ - ~~Butan~~-1,4-dioic acid
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid
 - $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - Ethanoic acid
 - $\text{(CH}_2\text{(CH}_2\text{))}_4\text{COOH}$ - Octanoic acid
 - $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enoic acid

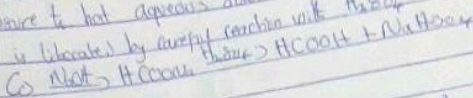
2) Physical appearance: - All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxylic acids are solid at room temperature.

- Boiling Point:** - The boiling point of carboxylic acid increases with increasing 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 in the molecules are soluble in water. This is due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases as the relative molecular mass increases as the structure becomes relatively more hydrocarbon in nature and covalent.

Industrial Preparations

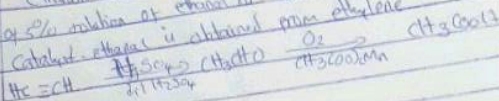
① From Carbon Dioxide

Methanoic acid (formic acid) is manufactured by a dry CO_2 under pressure to hot aqueous solution of NaOH . The free carboxylic acid is liberated by careful reaction with H_2SO_4 .



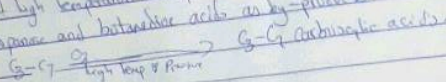
② From Ethanol

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 is obtained from ethylene.



③ From Petroleum

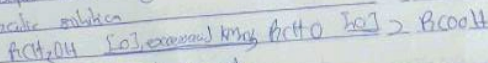
liquid phase air-oxidation of C₅-C₇ alkanes, obtainable from petroleum at high temperature and pressure will give C₅-C₇ carboxylic acids with methanoic, propanoic and butanoic acids as by-products.



Synthetic Preparations

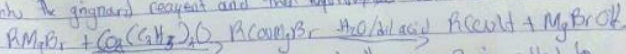
① Oxidation of primary alcohols and aldehydes

oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents i.e. $\text{K}_2\text{Cr}_2\text{O}_7$ or KMnO_4 in acidic solutions.

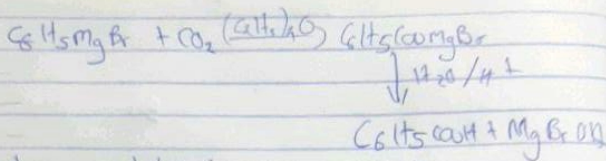


② Carboxylation of Grignard reagent

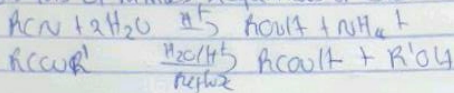
Aliphatic carboxylic acids are obtained by bubbling carbon dioxide into the Grignard reagent and then hydrolysed with dilute acid.



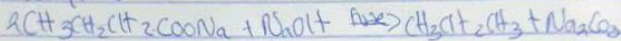
In the preparation of benzoic acid, the reagent is added to solid carbon dioxide (dry ice) which also serves as coolant to the reaction mixture.



3) Hydrolysis of nitriles, cyanamides or esters.



2) Decarboxylation



→ Reduction

