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Medicine and Surgery

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- i) HCOOH - Methanoic acid
 $\text{HOOCCH}_2\text{CH}_2\text{COOH}$ - Butane-1,4-dioic acid
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid
 $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - 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 Properties of Carboxylic acids.

i) Physical appearance.

All simple aliphatic carboxylic acids up to C_6 are liquids at room temperature. Most other carboxylic acids are solid at room temperature although anthracene carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

ii) 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.

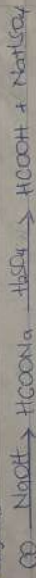
iii) Solubility:

Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water, this 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 insolvent. All carboxylic acids are soluble in organic solvents.

3. Industrial Preparations of Carboxylic Acids.

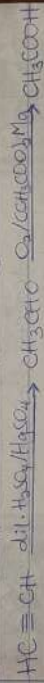
a. From carbon dioxide

Methanoic acid (formic acid) is manufactured by adding carbon(II)oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetrasodiumphosphate ($\text{Na}_2\text{P}_2\text{O}_7$).



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. Synthetic Preparation of Carboxylic Acids.

a. Oxidation of primary alcohols and aldehydes.

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



b. Carboxylation of Grignard reagent

Aliphatic carboxylic acids are obtained by bubbling carbonic oxide into the Grignard reagent and then hydrolyzed with dilute acid.



c. Hydrolysis of nitriles (cyanides) or esters



R (alkyl or aryl radical)



