

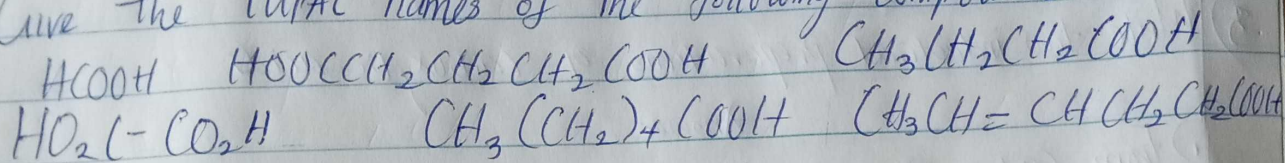
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MEDICINE AND SURGERY

19/MHS011323

CHM 102 ASSIGNMENT

1) Give the IUPAC names of the following compounds.



Answer.

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) Discuss briefly the physical properties of carboxylic acids under the following headings:

- i) physical appearance ii) Boiling point iii) Solubility.

Answer

i) 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 although anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

ii) Boiling points: Boiling points increase with increasing 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 largely due to their ability to form hydrogen bonds with water molecules.

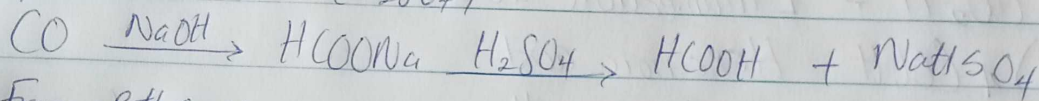
The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

3) Write two industrial preparations of carboxylic acids

Answer-

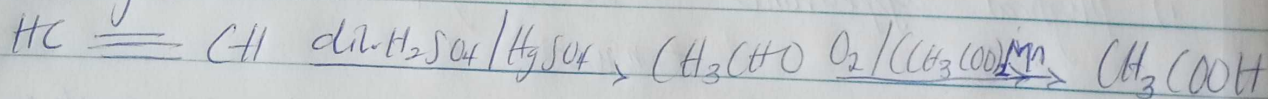
i) From carbon (II) oxide

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 tetraoxo sulphate (VI) acid (H_2SO_4).



ii) From ethanol

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

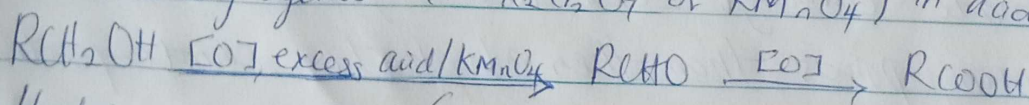


4) With equations and brief explanation, discuss the synthetic preparation of carboxylic acid.

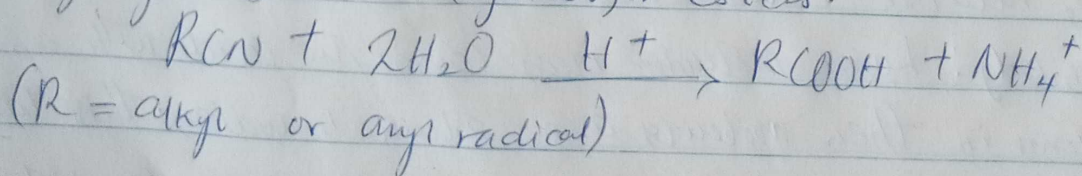
Answer.

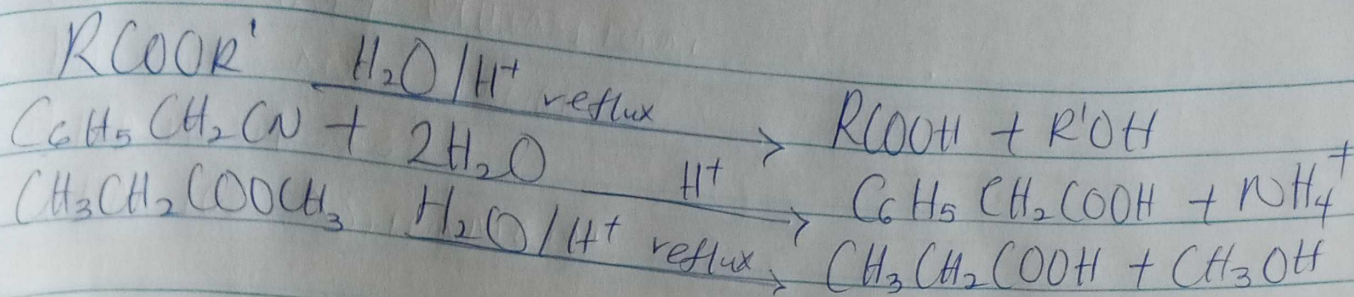
i) Oxidation of primary alcohols and aldehydes

This method can be used to prepare carboxylic acids using the usual oxidizing agents (i.e. $K_2Cr_2O_7$ or $KMnO_4$) in acidic solution.



ii) Hydrolysis of nitriles (Cyanides) or esters.

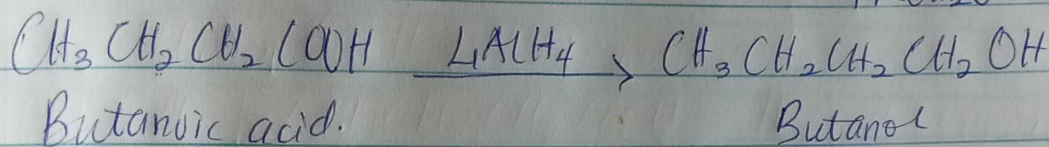
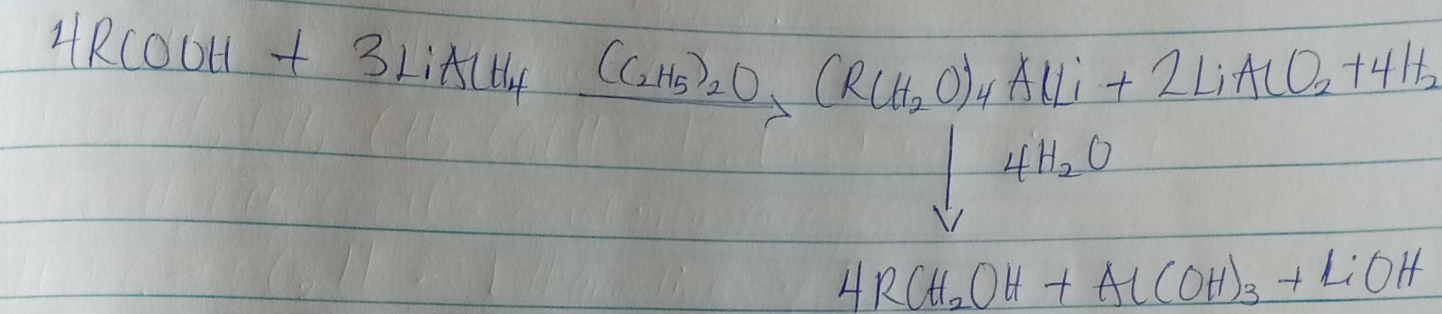




5) With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

Answer

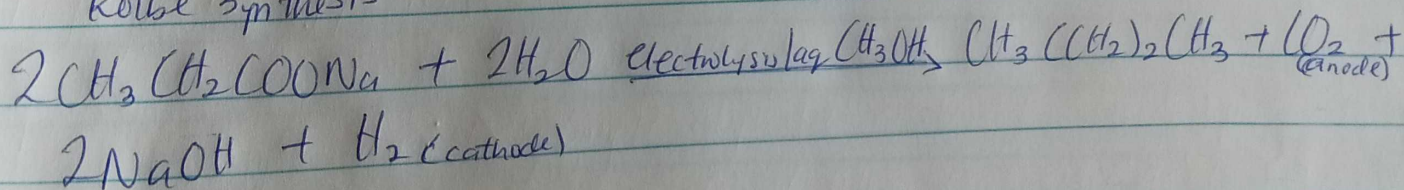
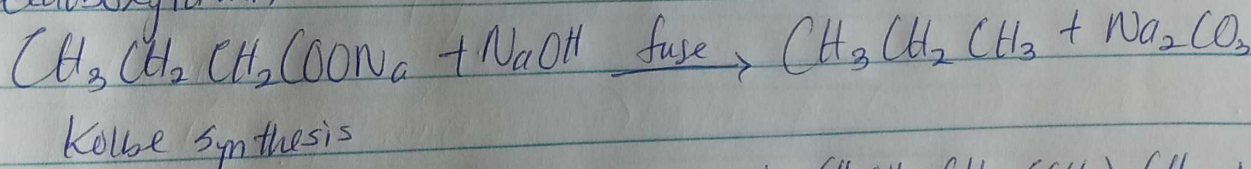
i) Reduction



Butanoic acid.

Butanol

ii) Decarboxylation



iii) Esterification

