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$\text{HCOOH}$  - methanoic acid.

$\text{HOOC(CH}_2)_4\text{COOH}$  - pentan-1,5-dioic acid

$\text{HO}_2\text{C-CO}_2\text{H}$  - 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.

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

2. i) Physical appearance.

All simple aliphatic carboxylic acids up to  $\text{C}_6$  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 increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting point than their aliphatic counterparts of comparable relative molecular mass.

iii) Solubility:

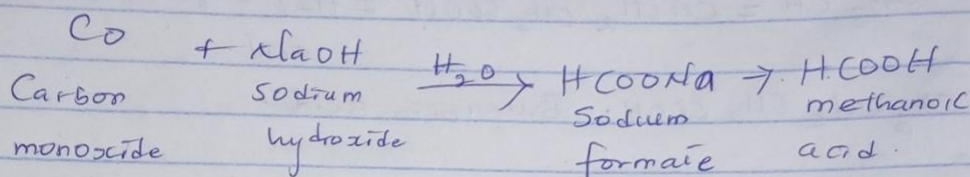
Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water, this is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases of the

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relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and have covalent.

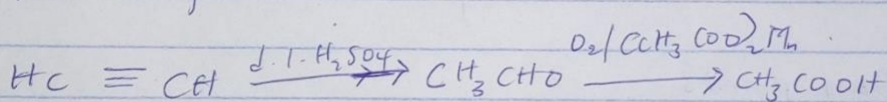
3i) from Carbon(II)oxide

It is made by the action of sulfuric acid upon Sodium formate which is produced from Carbon monoxide and Sodium hydroxide.



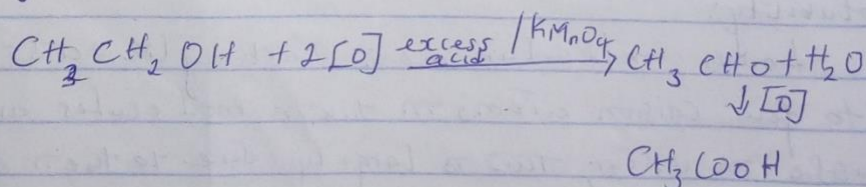
ii) from ethanal

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



ti) Oxidation of primary alcohols and aldehydes.

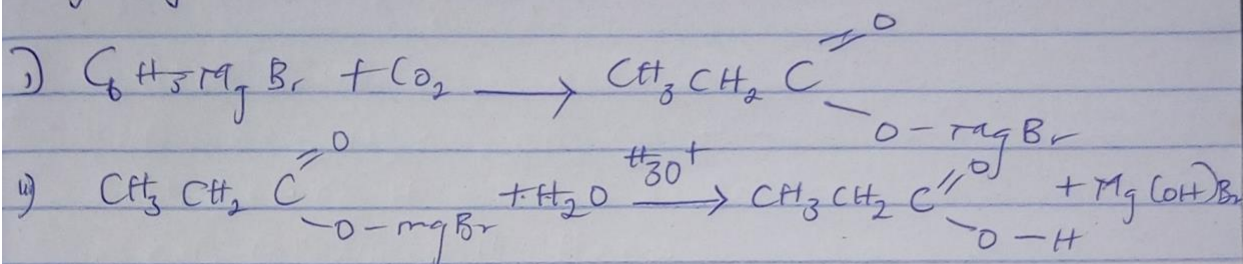
With the use of oxidizing agent such as  $\text{K}_2\text{Cr}_2\text{O}_7$  or  $\text{KMnO}_4$  in acidic solution, Carboxylic acids can be prepared from the oxidation of primary alcohols and aldehydes.



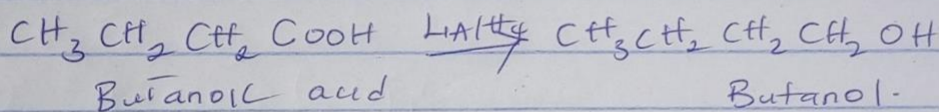
i) Carbonation of grignard reagent



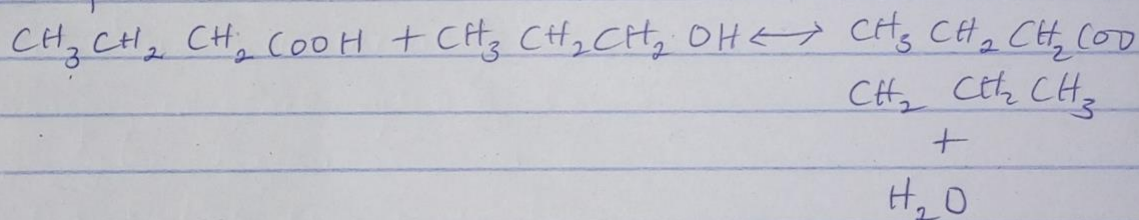
Aliphatic carboxylic acids are obtained by bubbling carbon(IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid.



5.1) Reduction to primary alcohol.



ii) Esterification



iii) Decarboxylation

