

CHM 102 - CARBOXYLIC ACIDS

1 Give the IUPAC names of these compounds

- a HCOOH - Methanoic acid.
- b $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - Pentan-1,5,dioic acid.
- c $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid.
- d $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - Ethanedioic acid
- e $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid
- f $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enoic acid

2 Properties of Carboxylic acids

i Physical appearance

All simple carboxylic acids up to C_{10} are liquids at room temperature while those higher than that are solids.

ii Boiling point

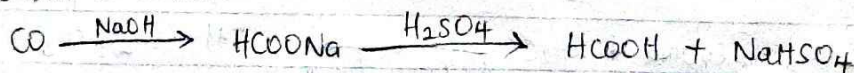
Boiling point increases with increasing molecular mass. Aromatic acids have higher melting points than their aliphatic counterparts.

iii Solubility

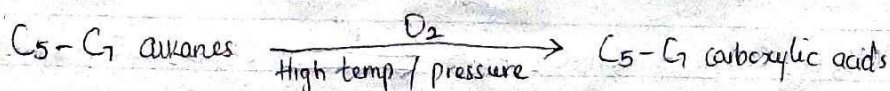
In water, lower molecular carboxylic acids with up to four carbon atoms are soluble due to their ability to form hydrogen bonds with water molecules. This solubility in H_2O decreases with increasing molecular mass because the structure becomes more hydrocarbon and covalent. However, all carboxylic acids are soluble in organic solvents.

3 Industrial Preparations

i From Carbon II oxide

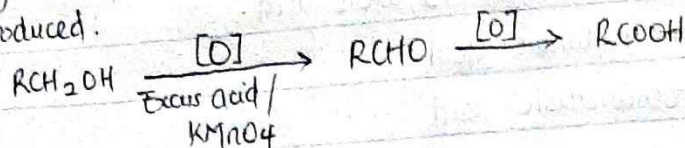


ii From petroleum



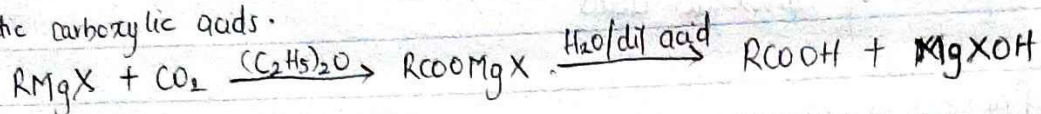
4 Synthetic preparations

- i Oxidation of primary alcohols & aldehydes
Using oxidizing agents like $K_2Cr_2O_7$ and $KMnO_4$ in acidic solution, acids can be produced.

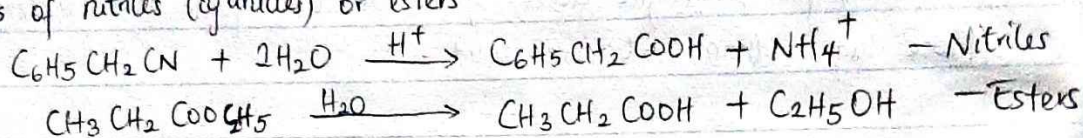


ii Carbonation of Grignard reagents

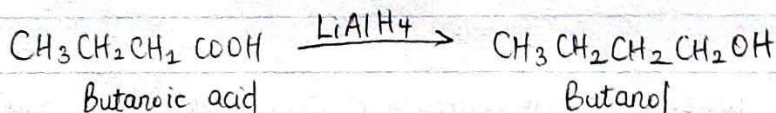
When CO_2 is bubbled into Grignard reagents and hydrolyzed with dilute acids, aliphatic carboxylic acids.



iii Hydrolysis of nitriles (cyanides) or esters

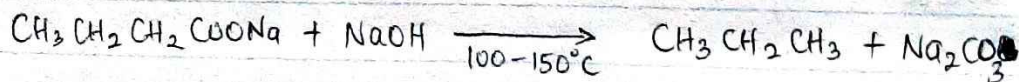


5i Reduction of carboxylic acids to primary alcohols

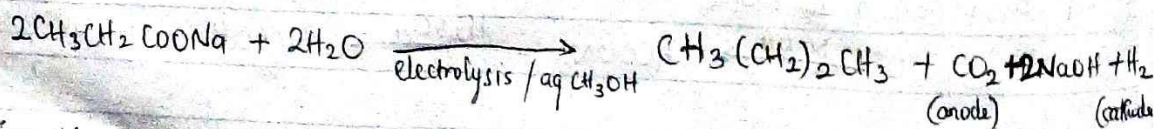


ii Decarboxylation to yield its derivative

--- Thermal decarboxylation



--- Kolbe's synthesis



iii Esterification

