

Name
Nat/Na
Dept

Aldehydes, Ketones and carboxylic acids

19/4/2022

MBS3S

- (1) Give the IUPAC names of the following compounds
- HCOOH → Methanoic acid
 - $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ → Propanoic, 3-dioic acid
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ → Butanoic acid
 - HOOC-COOH → Ethanedioic acid
 - $(\text{CH}_3\text{CH}_2)_2\text{C}(=\text{O})\text{OH}$ → Hexanoic acid.
 - $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ → Hex-4-enenoic acid

- (2) Discuss briefly the physical properties of carboxylic acid under the following headings.

i) Physical Appearance

All simple aliphatic carboxylic acids up to C_6 are liquids at room temperature. Most other carboxylic acids are solids 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 among the carboxylic acids e.g. crystalline solids and have higher boiling points than their aliphatic counterparts of comparable relative molecular mass.

iii) Solubility

Lower molecular mass carboxylic acid 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.

they largely fail to this, owing 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 hydrophobic in nature and hence covalent C=O carbonyl bonds are soluble in organic solvents.

3. Write two industrial preparations of carboxylic acids.

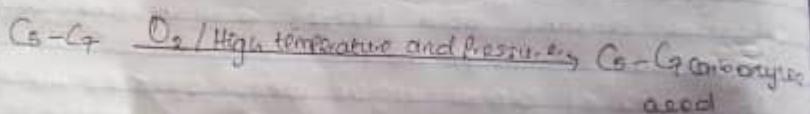
Wetton Carbonyl II acid

Methanolic acid (Formic acid) is manufactured by the carbon dioxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is neutralized by calcium carbonate with tetraborate sulphate ($\text{Na}_2\text{B}_4\text{O}_7$)



- (i) From Petroleum

Liquid phase air oxidation of C_5 - C_7 alkanes obtainable from petroleum at high temperature and pressure will give C_5 - C_7 carboxylic acids with methanol, propane and butane also acid as by-products.

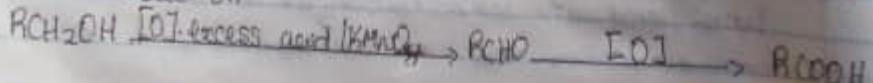


- (ii) With equations and brief explanations discuss the synthetic preparation of carboxylic acids.

Answer

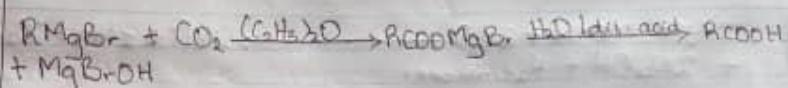
- ① Oxidation of primary alcohols and aldehydes

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 solution



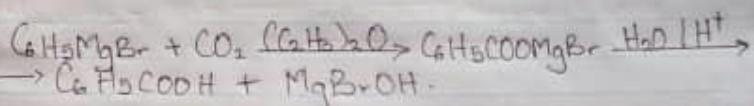
(ii) Preparation of Grignard reagent

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

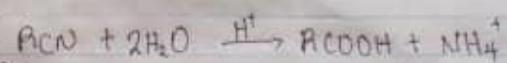


R may be 1°, 2°, 3° aliphatic aryl or aryl radical

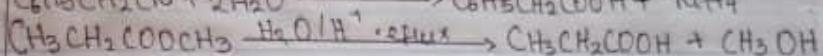
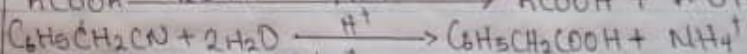
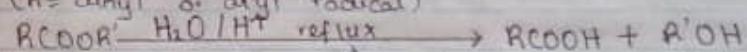
In the preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to the reaction mixture.



(iii) Hydrolysis of nitriles (cyanides) or esters



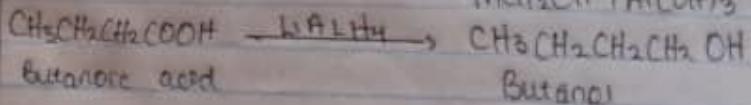
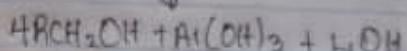
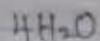
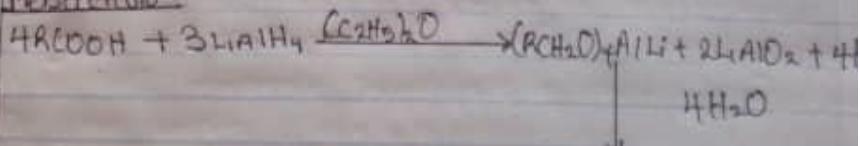
(R = alkyloxy or aryl radical)



(iv) With chemical equation only, discuss the reduction, decarboxylation and esterification of carboxylic acid.

Answer

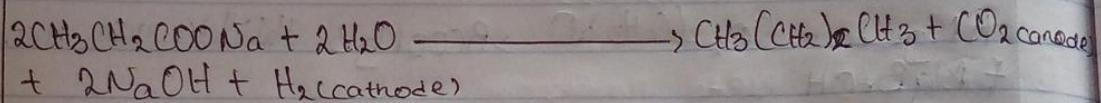
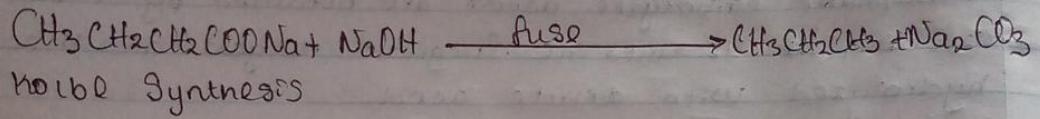
PREDICTION



Butanone acid

Butanol

(ii) Decarboxylation



(iii) Esterification

