

Chemistry 102 Assignment on  
Carboxylic Acids.

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Level: 100

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1) Give the Iupac names of the following compounds.

~~Answer~~

$\text{HCOOH}$  - Methanoic acid

$\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$  - Pent-1,5-dioic 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.

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

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

1) Physical appearance - All simple aliphatic carboxylic acid ~~with~~ up to  $\text{C}_{10}$  are liquid at room temperature while most other carboxylic acid are solid in room temperature except for anhydrous carboxylic acids (acetic acid) which is also known as glacial ethanoic acid which freezes to an ice-like solid below room temperature.

(ii) Boiling point: Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are ~~not~~ crystalline solids and have higher melting point than their aliphatic counterparts of comparable relative molecular mass.

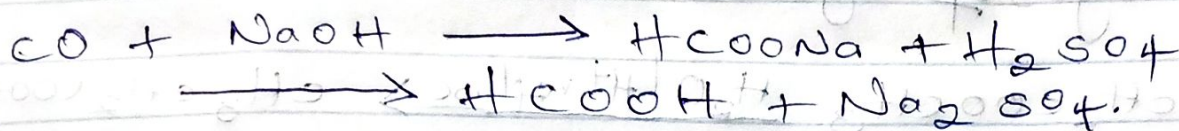
(iii) Solubility: lower molecular mass carboxylic acids with up to four carbon atoms are soluble in water, this largely due to their ability to form hydrogen bond with water molecules. The water solubility of carboxylic acids decreases with increasing relative molecular mass because the structure becomes more hydrocarbon in nature and <sup>hence covalent</sup> carboxylic acids are soluble in Organic Solvent.

(2) Write two Industrial preparation of Carboxylic acids

Answer

(i) From carbon (IV) oxide

Methanoic acid (Formic acid) can be ~~prepa~~ <sup>manufactured</sup> by adding carbon (IV) oxide to hot aqueous of sodium hydroxide, and the free carboxylic acid is liberated by careful reaction with tetraoxosulphate (VI) acid.



(ii) From petroleum

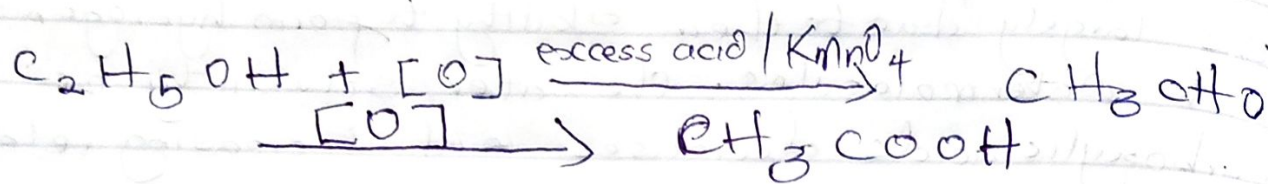
Liquid air-phase oxidation of  $\text{C}_6-\text{C}_7$  alkanes; Obtainable from petroleum at high temperature and pressure will give  $\text{C}_6-\text{C}_7$  carboxylic acid like methanoic, propanoic and butanoic acids as by-product.

(4) With Equations and brief explanation, discuss the Synthetic preparation of carboxylic acid.

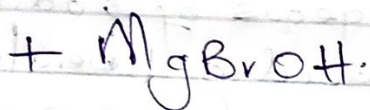
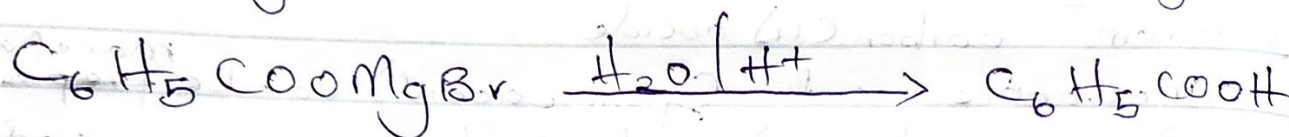
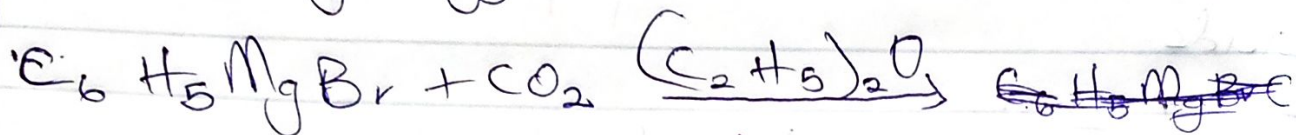
Answer

(i) Oxidation of primary alcohols and aldehydes :- Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids by

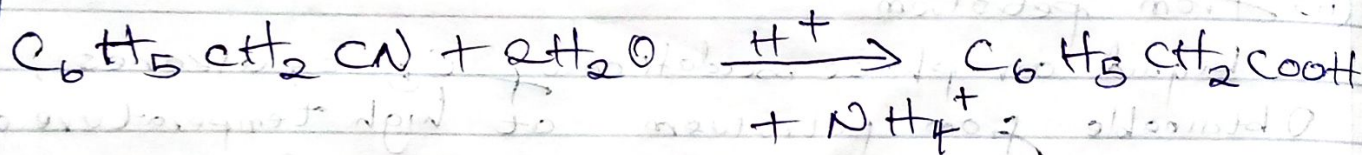
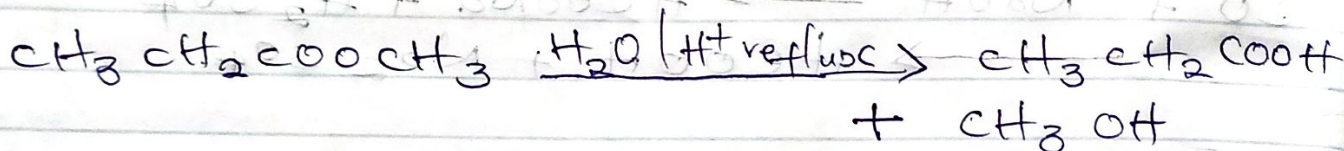
the usual oxidizing agent ( $K_2Cr_2O_7$  or  $KMnO_4$ ) in acidic solution.



② Carbonation of Grignard Reagent  
Aliphatic Carboxylic acid can be obtained by bubbling carbon dioxide into Grignard reagent and then hydrolyzed with dilute acid.



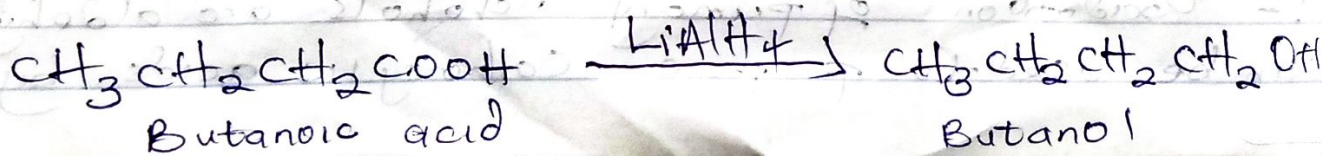
③ Hydrolysis of nitriles (Cyanides) or esters



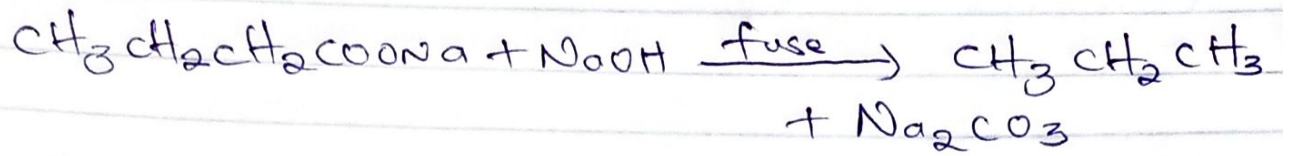
④ With Chemical ~~Reduction~~ <sup>Equation</sup> Only, Outline the reduction, decarboxylation and esterification of carboxylic acid.

Answer

(1) Reduction to primary alcohol



(i) Decarboxylation.



(ii) Esterification.

