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Department: Pharmacy

Chem 102 (Assignment)

Give the IUPAC names of the following compounds

HCOOH \rightarrow Methanoic acid

$\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ \rightarrow Penta-1,5-dioic acid

ii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ \rightarrow Butanoic acid

iii) $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ \rightarrow Ethanedioic acid

iv) $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ \rightarrow Hexanoic acid

v) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ \rightarrow Hex-4-enoic acid

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

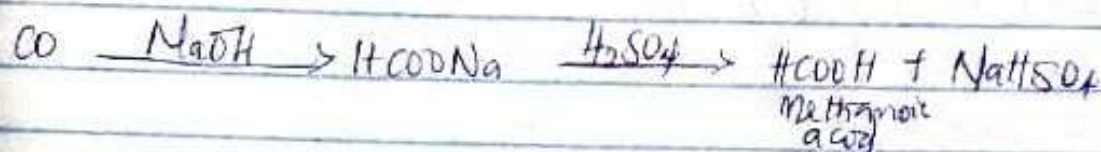
i) Physical appearances: All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature but above 10 they are solid.

ii) Boiling points: It increases with increasing relative 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 their 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 correlated. All carboxylic acids are soluble in organic solvents.

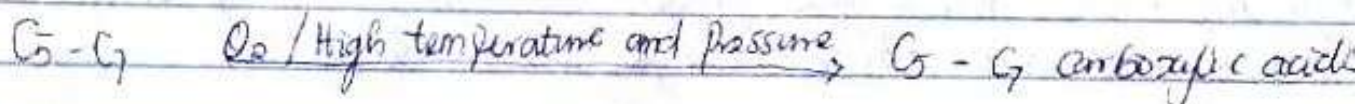
3) Write two industrial processes Preparation of carboxylic acids
a From carbon (II) oxide

Methanoic acid (formic acid) is manufactured by adding oxide under pressure to hot aqueous solution of sodium hydroxide. Free carboxylic acid is liberated by careful reaction with tetraoxo acid (H_2SO_4).



b From Petroleum

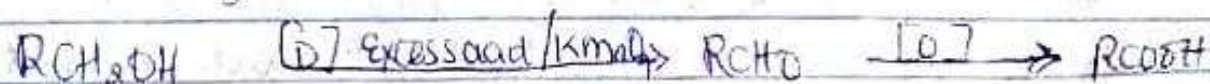
Liquid phase air oxidation of $C_5 - C_7$ alkanes, obtainable from petrol at high temperature and pressure will give $C_5 - C_7$ carboxylic acid w. Methanoic, Propanoic and butanedioic acids as by products.



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

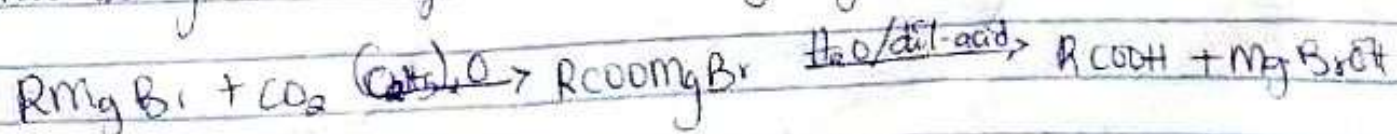
a. Oxidation of primary alcohols and aldehydes

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



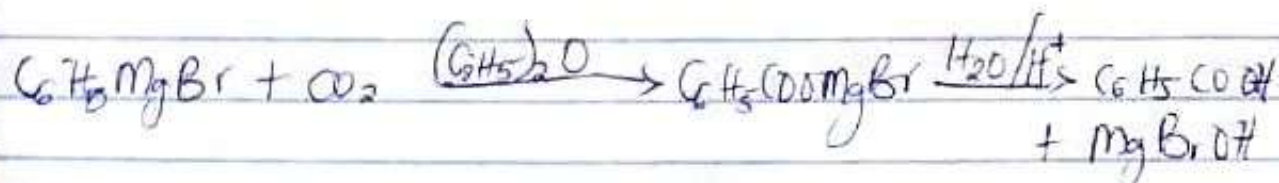
4b) Carbonation of Grignard reagent \rightarrow (Arnyl Br)

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

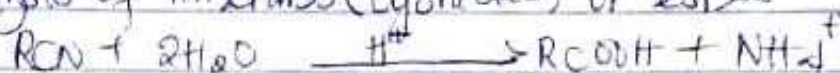


R^o may be $1^o, 2^o, 3^o$ aliphatic alkyl or aryl radical

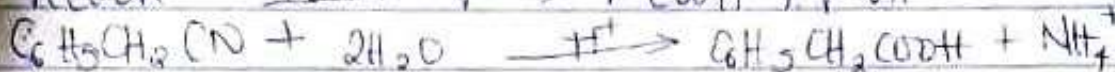
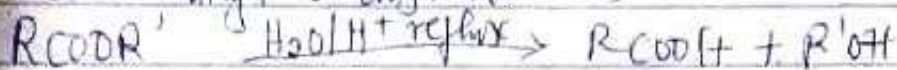
In the preparation of benzoic acid, the reagent is used to solvate carbon(IV) oxide (dry ice) which also serves as coolant to the reaction mixture



Hydrolysis of nitriles (cyanides) or esters-

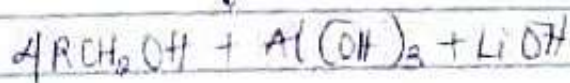
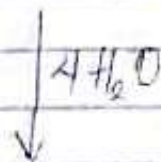
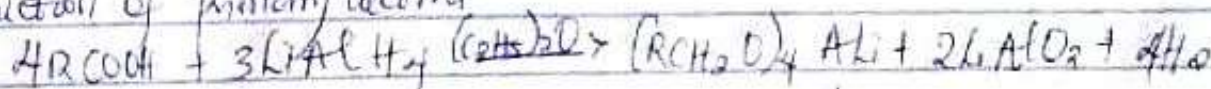


(R = alkyl or aryl radical)



5. With chemical equations only, outline the reduction, decarboxylation and esterification of carboxylic acids

a. Reduction of primary alcohol



b. Decarboxylation



Kofler Synthesis



c. Esterifizierung

