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Department: Medicine and Surgery

Matric number: 19/MH501/369

Course: CHEM 102

Assignment

1) HCOOH - Methanoic acid

$\text{HOOCCH}_2\text{CH}_2\text{COOH}$ - Butan-1,4-dioic acid

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

2. i) Physical appearance:

All simple carboxylic acids up to C_{10} 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 Point

Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids.

Ethanoic acid

Cr^{VI} -oxidation

manganite Cr^{VI}

from ethylene

$\text{HC}\equiv\text{CH}$

ii) From Petroleum

Liquid phase

From petroleum

C_5-C_7 carb

butanedioic

C_5-C_7 —

4. Synthetic Pr

i) Oxidation of

Oxidation of

to prepare car

i.e. $\text{K}_2\text{Cr}_2\text{O}_7$

$\text{RCH}_2\text{OH} \xrightarrow{\text{I}_2}$

ii) Carbonation

Aliphatic Ca

Carbon(IV) ox

hydrated

room temperature although anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature

i) Boiling Point

Boiling point 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.

ii) Solubility

Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water, this 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 covalent. All carboxylic acids are soluble in organic solvents.

3. Industrial Preparation of Carboxylic acid

i) From ethanol

Oxidation to prepare
C.e. $K_2Cr_2O_7$
 RCH_2OH

ii) Carbonate
Aliphatic
Carbonate
hydrolyze
 $RMgBr + CO_2$

In the preparation of solid carbonyl compound

Coolant to
 C_6H_5MgBr
 $+ MgBrO$

Note: R may

iii) Hydrolysis

$RCN + 2H_2O$

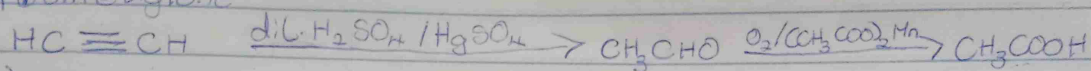
CR = alkyl

$RCOOR'$

$C_6H_5CH_2CO$

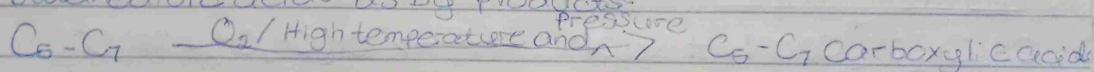
CH_3CH_2CO

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



ii) From Petroleum

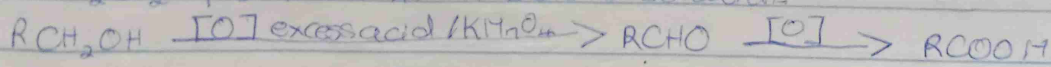
Liquid phase air oxidation of C_5 - C_7 alkanes, obtainable from petroleum at high temperature and pressure will give C_5 - C_7 carboxylic acids with methanoic, propanoic and butanedioic acids as by products.



4. Synthetic Preparations of Carboxylic acids

i) 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.

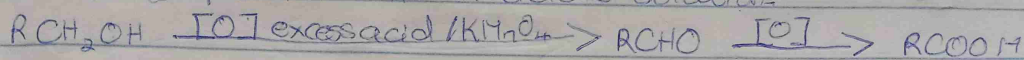


ii) Carbonation of Grignard reagent

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

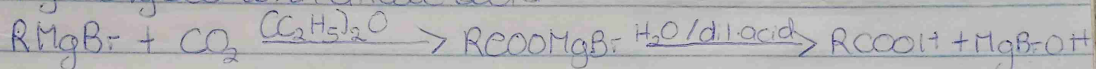
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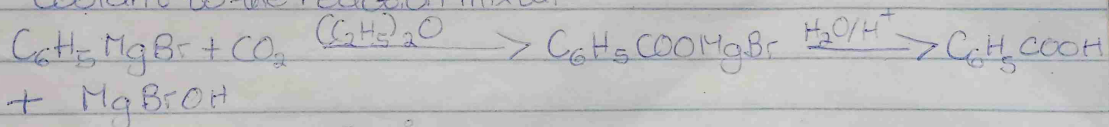


ii) Carbonation of Grignard reagent

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

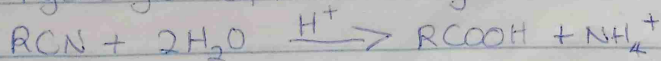


In the preparation of benzoic acid, the reagent is added to solid carbon(IV) oxide (dry ice) which also serves as a coolant to the reaction mixture.

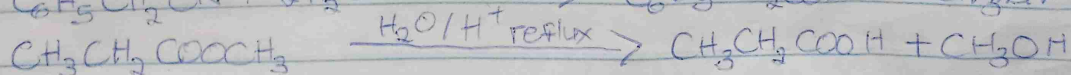
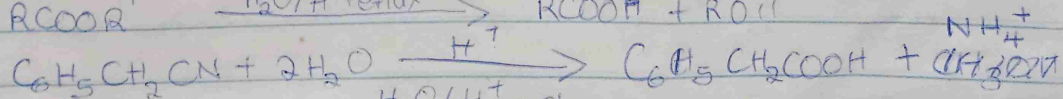
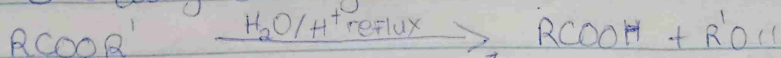


Note: R may be 1° , 2° , 3° aliphatic alkyl or aryl radical

iii) Hydrolysis of nitriles (cyanides) or esters

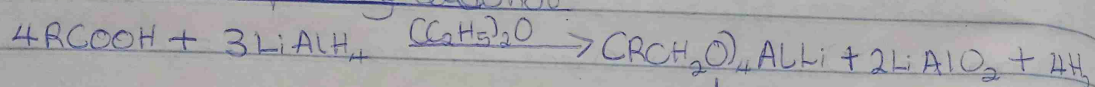


(R = alkyl or aryl radical)

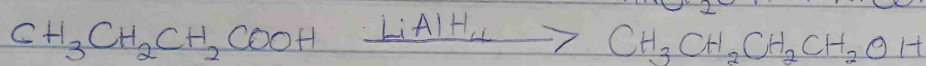


5. Chemical Reactions of Carboxylic acid

i) Reduction to primary alcohol



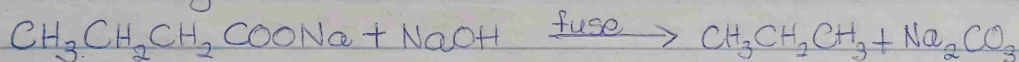
$4\text{H}_2\text{O}$



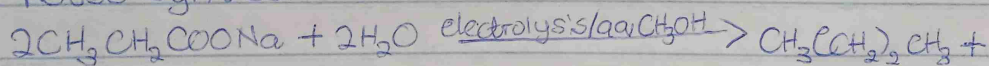
Butanoic acid

Butanol

ii) Decarboxylation



Kolbe Synthesis



CO_2 (anode) + 2NaOH + H_2 (cathode)

