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COURSE CODE: CHM 102

LEVEL: 100

Chemistry Assignment IV

1 Give the IUPAC names of the following compounds

a HCOOH

Answer: Methanoic acid

b ~~HCOOH~~ $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$

Answer: Pentan-1,5-dioic acid

c $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

Answer: Butanoic acid

d ~~$\text{HO}_2\text{C}-\text{CO}_2\text{H}$~~ $\text{HO}_2\text{C}-\text{CO}_2\text{H}$

Answer: Ethanedioic acid

e $\text{CH}_3(\text{CH}_2)_4\text{COOH}$

Answer: Hexanoic acid

f $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$

Answer: Hex-4-enoic acid

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

i Physical appearance

Answer: All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxylic acids are solid and white anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid becomes an ice-like solid below room temperature.

ii Boiling point

Answers: Their ~~po~~ boiling points ~~increasing~~ ^{increases} with increasing

relative molecular mass.

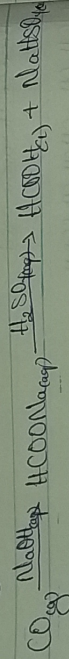
ii: Solubility:

Answer: The water solubility of the acids decreases as their relative molecular mass increases because their structures become relatively more hydrocarbon in nature and more covalent. All carboxylic acids are soluble in organic solvents.

3 Write two industrial preparations of carboxylic acids.
Answers:

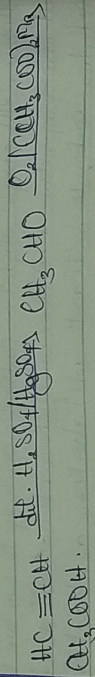
a From Carbon(II) oxide

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



b From ethanol

Ethanoic acid ~~is formed commercially by the liquid phase~~ can be produced. Ethanoic acid is formed commercially by the liquid phase air-oxidation of 5% solution of ethanol using manganese(II) sulfate catalyst. Ethanol itself is obtained from ethylene

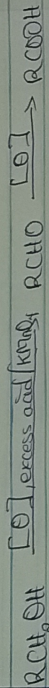


4. With equations and brief explanations, discuss the synthetic preparation of carboxylic acid.

Answers

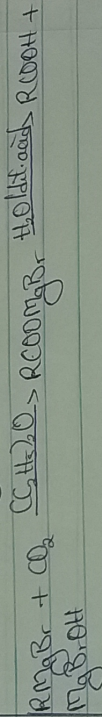
a. Oxidation of primary alcohols and aldehydes

Primary alcohols and aldehydes can be used to produce carboxylic acids by oxidation using the usual oxidizing agents such as $K_2Cr_2O_7$, etc., in an acidic solution.

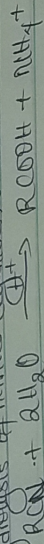


b. Carbonation of Grignard reagent

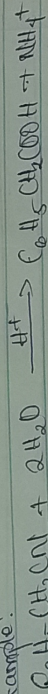
Aliphatic carboxylic acids are obtained by bubbling carbon dioxide into the Grignard reagent and then hydrolyzed with dilute acid.



c. Hydrolysis of nitriles (cyanides) or esters



Example:



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

Answers

a. Reduction

