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MEDICINE AND SURGERY

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CHM 102

ASSIGNMENT ON CARBOXYLIC ACIDS

1. i) HCOOH- Methanoic acid

ii) HOOCCH2CH2CH2COOH- Pentan-1,3-dioc acid

iii) CH3CH2CH2COOH- Butanoic acid

iv) HO2C-CO2H- Ethanoic acid

v) CH3(CH2)4COOH- Hexanoic acid

vi) CH3CH=CHCH2CH2COOH- Hex-4-enoic acid

1. i) Physical appearances: At room temperature aliphatic carboxylic acids up to ten carbons (C10) are liquids while most above this number of carbons are solid.

ii) Boiling point: The boiling points of carboxylic acids increase with increase in their relative molecular masses,i.e. increasing boiling point

methanoic acid< ethanoic acid< propanoic acid….

However note that the boiling points of aromatic carboxylic acids are higher than their corresponding aliphatic acids.

iii) Solubility: All carboxylic acids are soluble in organic solvents but their solubility in water decreases as their relative molecular masses increase which causes them to become more hydrocarbon in nature. However carboxylic acids from C1-C4 are very soluble in water due to the presence of hydrogen bonding between them and the water molecules.

1. Industrial preparation of carboxylic acid:

i) From Ethanol: Ethanoic acid can be produced by the complete oxidation of ethanol, it oxidizes first to ethanal and then ethanoic acid. Ethanoic acid is obtained from ethanal by using manganite (II) ethanoate catalyst.

CH3CH2OH dil H2SO4/ K2Cr2O7 CH3CO( Ethanal)O2/ (CH3COO)2Mn CH3COOH( Ethanoic acid)

ii) From Petroleum: C5-C7 carboxylic acids are produced at high temperature and pressure by liquid-phase air oxidation of C5-C7 alkanes. By-products like methanoic and propanoic acids are also produced.

C5-C7 O2/ High temperature and pressure C5-C7 Carboxylic acids

1. Synthetic preparation of carboxylic acids:

Carbonation of Grignard Reagent: Aliphatic carboxylic acids are produced by reacting Grignard reagent with CO2 and then hydrolyzing the product with dilute acid.

CH3CH2MgBr + CO2 CH3CH2COOMgBr dil. H2SO4 CH3CH2COOH + MgBrOH

Grignard reagent (Propanoic acid)

1. i) Reduction:

( Propanoic acid) (Propanol)

CH3CH2COOH LiAlH4 CH3CH2CH2OH

ii) Decarboxylation:

* Thermal decarboxylation: CH3COOH 100-1500C CH3CH3
* Decarboxylation using soda lime CH3CH2COONa + NaOH CH3CH3  + Na2CO3

iii) Esterification:

CH3CH2COOH + CH3CH2OH H+ CH3CH2COOCH3CH2  + H2O

Ethanoic acid ethanol ethyl propanoate water