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***19/eng03/019***

***Civil engineering***

 ***Chm 102***

**Question**

Assignment

1. Give the IUPAC names of the following compounds

HCOOH                                             HOOCCH2CH2CH2COOH

CH3CH2CH2COOH                           HO2C-CO2H

CH3(CH2)4COOH                               CH3CH=CHCH2CH2COOH

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

1. Physical appearance    ii. Boiling point           iii. Solubility

3. Write two industrial preparations of carboxylic acids

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

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

Answers;

1. Methanoic acid

Pentanedioic acid

Butanoic acid

Ethanedioic acid

Pentanoic acid

2E,4E hexa-2,4-dienoic acid

1. Physical appearance;

 Many carboxylic acids are colorless liquids with disagreeable odors. The carboxylic acids with 5 to 10 carbon atoms all have “goaty” odors (explaining the odor of Limburger cheese). These acids are also produced by the action of skin bacteria on human sebum (skin oils), which accounts for the odor of poorly ventilated locker rooms. The acids with more than 10 carbon atoms are waxlike solids, and their odor diminishes with increasing molar mass and resultant decreasing volatility.

Boiling point;

Carboxylic acids exhibit strong hydrogen bonding between molecules. They therefore have high boiling points compared to other substances of comparable molar mass.

Solubility;

The carboxyl group readily engages in hydrogen bonding with water molecules . The acids with one to four carbon atoms are completely miscible with water. Solubility decreases as the carbon chain length increases because dipole forces become less important and dispersion forces become more predominant. Hexanoic acid [CH3(CH2)4COOH] is barely soluble in water (about 1.0 g/100 g of water). Palmitic acid [CH3(CH2)14COOH], with its large nonpolar hydrocarbon component, is essentially insoluble in water. The carboxylic acids generally are soluble in such organic solvents as ethanol, toluene, and diethyl ether.

1. Preparation from Aldehydes;

As discussed in the above topic, Preparation of carboxylic acid is possible from the usual strong oxidizing agents. Carboxylic acids formation is possible with mild oxidizing agents such as Tollen’s reagents [Ag(NH 3) 2 +OH −] and manganese dioxide (MnO2).

CH3CHO CH3COOH

Preparation from Grignard Reagents

The carboxylic acid formation is possible by Grignard reagents reaction. The reaction of Grignard reagents with crushed dry ice or solid carbon dioxide leads to the formation of salts of carboxylic acids. Further, the acidification of the salts of a carboxylic acid with mineral acids leads to the formation of corresponding carboxylic acids.

Thus, preparation of Grignard reagents and nitriles is possible from alkyl halides. The preparation techniques help in the conversion of alkyl halides into the respective carboxylic acids. The resultant carboxylic acid will always have one carbon atom more than the corresponding alkyl halides.

 Dry ether C H3O+

R- Mg – X + O=C=O R – C RCOOH + Mg(OH)X

 OMgx

1. Grignard reagent react with carbon dioxide (either in the gaseous form, which is bubbled through the solution, or as the solid dry ice) to give magnesium salts of carboxylic acids, which are converted to the acids themselves upon treatment with acid: RMgBr + CO2→ RCOO− +MgBr + HCl → RCOOH.
2. Reduction;



Esterification;



Decarboxylation;

