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MATRIC NUMBER: 19/ENG05/016

DEPARTMENT: MECHATRONICS ENGINEERING

COURSE CODE: CHM102

Covid-19 holiday assignment

Question1

Give the IUPAC names of the following compounds.

- (a) HCOOH – Methanoic acid
- (b) HOOCCH₂CH₂CH₂COOH – Pentan-1,5-dioic acid
- (c) CH₃CH₂CH₂COOH –Butanoic acid
- (d) HO₂C – CO₂H – Ethanedioic acid
- (e) CH₃(CH₂)₄COOH –Hexanoic acid
- (f) CH₃CH=CHCH₂CH₂COOH – 4-hexenoic acid or hex-4-enoic acid

Question 2

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

- i. Physical appearance
- ii. Boiling point
- iii. Solubility

(i) **Physical appearance:**

All simple aliphatic carboxylic acids up to C₁₀ are liquids 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 points:**

Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids and crystalline solids and have higher melting point than their aliphatic counterparts of comparable relative molecular mass.

(iii) **Solubility:**

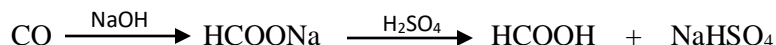
Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water this is largely due to their ability to form hydrogen bonds with water molecules. The solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvent.

Question 3

Write two industrial preparation of carboxylic acids.

(a) From carbon(II) oxide

Methanoic acid (formic acid) is manufactured by adding carbon(II)oxide under pressure to hot aqueous solution of NaOH. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate(VI)acid.



(b) From ethanol:

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

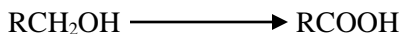


Question 4

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

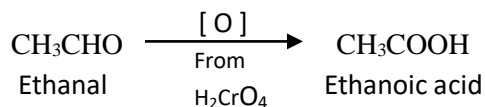
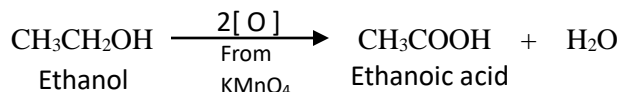
(a) Oxidation of primary alcohols and aldehydes

The oxidation of primary alcohols is a common method for the synthesis of carboxylic acids:



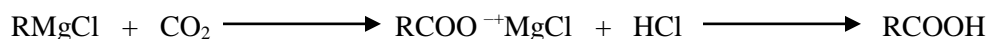
This requires a strong oxidizing agent, the most common being chromic acid(H_2CrO_4), potassium tetraoxomanganate (VII),(KMnO_4), and nitric acid(HNO_3).

Aldehydes are oxidized to carboxylic acids more easily (by many oxidizing agent).

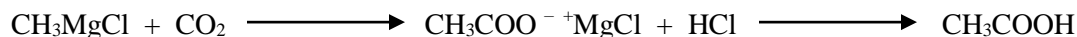


(b) Reaction of carbon (II) oxide with Grignard reagent

Grignard reagents react with carbon (II) oxide(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:



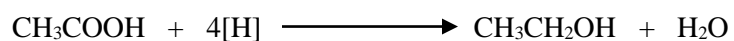
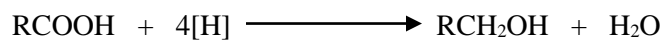
This method adds one carbon atom to the carbon skeleton unlike the previous method.



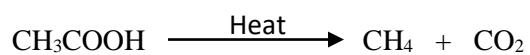
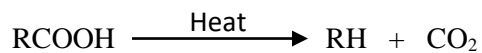
Question 5

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

(a) **Reduction of carboxylic acid:**



(b) **Decarboxylation of carboxylic acid:**



(c) **Esterification of carboxylic acid:**

