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**DEPARTMENT:** NURSING

**COURSE CODE:** CHM102

**ASSIGNMENT**

1. **Give the IUPAC names of the following compounds**

* HCOOH- (Methanoic acid).
* HOOCCH₂CH₂CH₂COOH-(Pentan-1, 5-dioic acid).
* CH₃CH₂CHCOOH- (Butanoic acid).
* HOOC-COOH- (Ethanedioic acid).
* CH₃CH₂CH₂CHCOOH-(Pentanoic acid).
* CH3CH=CHCH2CH2COOH- (Hex-4-eneoic acid).

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

* Physical appearance: All simple aliphatic carboxylic acids up to C₁₀ are liquids at room temperature. Most other carboxylic acids are solid 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.
* Boiling points: Boiling points increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids have higher melting points than their aliphatic counterparts of comparable relative molecular mass.
* 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 from 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.

1. **Write two industrial preparations of carboxylic acids.**

* From carbon (ii) oxide: Methanoic acid is manufactured by adding carbon (ii) oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate(VI) acid (H₂SO₄)

CO NaOH HCOONa H₂SO₄ HCOOH + NaHSO₄

* 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.

HC= CH dil H₂SO₄ CH₃CHO CH₃COOH

1. **With equations and brief explanations discuss the synthetic preparation of carboxylic acid**

* 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 k₂Cr₂O₇ or KMnO₄) in acidic solution

RCH2OH KMnO₄ RCHO RCOOH

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

RMgBr + CO2 (C₂H₃)₂O RCOOMgBr H₂O/Dil. acid RCOOH + MgBrOH

* Hydrolysis of nitriles( cyanides) or esters

RCN+ 2H₂O H⁺ RCOOH + NH₄⁺

RCOOR’ H₂O/H⁺ reflux RCOOH + R’OH

C₆H₅CH₂CN + 2H₂O H⁺ C₆H₅CH₂COOH + NH₄⁺

CH₃CH₂COOCH₃ H₂O/H⁺ reflux CH₃CH₂COOH + CH₃OH

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

4RCOOH+3LiAIH4 (RCH₂O)4AlLi+2LiAIO2+4H2 4RCH₂OH + Al(OH) + LiOH

CH₃CH₂CH₂COOH LiAlH₄ CH₃CH₂CH₂CH₂OH

Butanoic acid butanol

**Decarboxylation**

CH3CH₂CH₂COONa+NaOH fuse CH₃CH₂CH₃⁺ Na₂CO₃

Kolbe synthesis

Electrolysis/aq. CH3OH

2CH₃CH₂COONa+2H₂O Aq. CH₃OH CH₃ (CH₂)2CH₃+CO₂ (Anode) +2NaOH+H₂ (cathode)

**Esterification**

CH₃CH₂CH₂COOH+ CH₃CH₂CH₂OH H⁺ CH₃CH₂CH₂COOCH₂CH₂CH₃ + H₂O