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ASSIGNMENT ON CARBOXYLIC ACID

- Give the IUPAC names of the following compounds.
 (a)HCOOH----Methanoic acid
 (b)HOOCCH₂CH₂CH₂CH₂COOH ---- pentanol,5-dioic acid
 (c)HO₂C-CO₂H-----Ethanedioic acid
 (d)CH₃(CH₂)₄COOH-----Hexanoic acid
 (e)CH₃CH=CHCH₂CH₂CH₂COOH-----Hex-4-eneoic acid
- 2. Discuss briefly the physical properties of carboxylic acids under the following headings.
 (i) physical appearance: all simple aliphatic carboxylic acids up to C₁₀ are liquid at room temperature. Most other carboxylic acids are solid at room temperature

Although anhydrous carboxylic acids eg. Acetic acids freezes to an ice-like solid below the room temperature.

(ii) Boiling point: boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting point than their aliphatic counter parts of comparable relative molecular mass

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

3. Write two industrial preparation of carboxylic acids.a. From carbon(ii) oxide

 $CO+NaOH. \longrightarrow HCooNa + H_2 SO_4 HCOOH + NaHSO_4$

(b)from ethanol.

 $\begin{array}{ll} HC=CH + dil \ H_2so_4/Hgso4 \longrightarrow & CH_3CHO \\ O/(CH \ _3C\Theta)Mn & CH_3COOH \ (Ethanoic \ acid) \end{array}$

- 4. With Equation and brief explanation, discuss the synthetic preparation of carboxylic acid.
 - (a) Oxidation of primary alcohols and aldehydes.

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acid using $K_2cr_2O_7$ or kMno₄ as oxidizing agent. RCH₂OH (O)/Kmno₄ \rightarrow RCHO-(\odot) RCOOH.

 $\begin{array}{ll} CH_{3}CH_{2}OH (O)/KMNO \rightarrow & CH_{3}CHO (\Theta) \\ CH_{3}COOH (Ethanoic acid) & \end{array}$

- (b) Carbonation of Grignard reaction. Aliphatic carboxylic acids are obtained by bubbling carbon (iv) oxide into the Grignard reagent and then hydrolysed with dilute acids. RMgBr + Co₂ (C₂H₅)₂O \longrightarrow RCOOMgBr (H₂O/dil acid) RCOOH +MgBrOH C₆H₅MgBr +CO₂ (C₂H₅)₂O \longrightarrow C₆H₅COOMgBr (H₂O/H⁺) \rightarrow C₆H₅COOHgBr (H₂O/H⁺) \rightarrow
- (c) Hydrolysis of cynides or esters. Cyanides: $RCN+2H_2O(H+) \longrightarrow RCOOH$ $+NH_4^+$

 $C_{6}H_{5}CH_{2}CN + 2H_{2}O (H^{+}) \rightarrow$ $C_{6}H_{5}CH_{2}COOH + NH_{4}^{+}$ Esters: RCooR[|](H₂O/H⁺reflux) \longrightarrow RCOOH + R[|]OH CH₃CH₂COOH (H2O/H+) \longrightarrow CH₃CH₂COOH (H2O/H+) \longrightarrow CH₃CH₂COOH + CH₃OH

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

a)reduction. $4RCooH + 3LiALH_4 (C_2H_5)_2O$ $(RCH_2O)_4AlLi + 2LiAlO_2 + 4H_2O$ $CH_3CH_2CH_2COOH (LiAlH_4)$ $CH_3CH_2CH_2CH_2OH$ Butanoic acid butanol b)Decarboxylation. $CH_3CH_2CH_2CooNa + NaOH$ fuse \rightarrow $CH_3CH_2CH_3 + Na_2co_3$ c) esterification. $CH_3COOH + CH_3CH_2OH \rightarrow$

 $CH_3CH_2COOCH_2CH_3 + H_2O$