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DEPT: CIVIL ENGINEERING

MATRIC NO: 19/ENG03/007

CHM 102

1. HCOOH ---- methanoic acid

   $CH_3CH_2CH_2COOH$----- Butanoic acid

   $CH_3(CH_2)_4COOH$------- Hexanoic acid

   $HOOCCH_2CH_2CH_2COOH$ ---- Pentan- 1, 5-dioic acid
   $HO_2C\text{-}CO_2H$ ---- Ethanedioic acid
   $CH_3CH{=}CHCH_2CH_2COOH$ ----- Hex-4-eneoic acid
2. I) physical appearance
   All simple aliphatic carboxylic acids up to C_{10} 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 room temperature.
   ii) Boiling points
   boiling point increases with increasing with relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points 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 largely due to their ability to form hydrogen bonds with water molecules
3. I) 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 (H_2SO_4)
   ii) from ethanol
   ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganite(II) ethanoate catalyst. Ethanol itself is obtained from ethylene.
4. Oxidation of primary alcohols and aldehydes
   It can be used to prepare carboxylic acids using the usual oxidizing agents ($k_2Cr_2O_7$) in acidic solution.
   $RCH_2OH \xrightarrow{\text{excess acid/}KMnO_4}RCHO \xrightarrow{[O]} RCOOH$
5. Reduction to primary

$4\ RCO_2H + 3\ LiAlH_4 \text{ether} \longrightarrow 4\ H_2 + 4\ RCH_2OM + \text{metal oxides} H_2O \longrightarrow 4RCH_2OH + \text{metal hydroxides}$

Decarboxylation

$2CH_3CH_2COONa + 2H_2O \xrightarrow{\text{electrolysisi/aq } CH_3OH} CH_3(CH_2)_2CH_3 + CO_{2(\text{anode})} + 2NaOH + H_{2(\text{cathode})}$

Esterification

$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \xleftarrow{H^+} CH_3CH_2CH_2COOCH_2CH_2CH_3 + H_2O$