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**MATRICULATION NUMBER: 19/MHS01/062**

**DEPARTMENT: Medicine and Surgery**

**COLLEGE: MHS**

1. HCOOH : Methanoic acid

 b.) HOOCCH2CH2CH2COOH : Pentane-1,3-dioc acid

c.) CH3CH2CH2COOH : Butanoic acid

d.) HO2CCO2H : Ethanedioc acid

e.) CH3(CH2)4COOH : Hexanoic acid

f.) CH3CH=CHCH2CH2COOH : Hex-4-eneoic acid

1. PHYSICAL PROPERTIES OF CARBOXYLIC ACIDS

PHYSICAL PROPERTIES: All simple aliphatic carboxylic acids up to C10 are liquids at room temperature. Other carboxylic acids are solid at room temperature although anhydrous carboxylic acid (acetone acid) freezes to an ice-like solid below the room temperature. The carboxylic acids with 5-10 carbon atoms all have “goaty” odors. The acids with more than 10 carbon atoms are wax like solids, and their odor diminishes with increasing molar mass and resultant decreasing volatility.

BOILING POINTS: Carboxylic acids exhibit strong hydrogen bonding between molecules. They therefore have high boiling points compared to other substances of comparable molar mass. Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

SOLUBILITY: The carboxylic 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 becomes more predominant. 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. Hexanoic acids barely soluble in water (1.0g/100g of water). Palmitic acid with its large non-polar hydrocarbon component is essentially insoluble in water. The carboxylic acids generally are soluble in such organic solutes as ethanol, toluene and diethyl ether.

1. INDUSTRIAL PREPARATION OF CARBOXYLIC ACIDS
2. FROM ALCOHOLS (ETHANOL): Ethanoic acid is obtained commercially by the liquid phase air oxidation of 5 percent solution of ethanol to ethanoic acid using manganite(II)ethanoate catalyst. Ethanol itself is obtained from ethylene.

HC=CH dil,H2SO4/HgSO4 CH3CHO O2/(CH3COO)Mg HCOOH + NaHSO4

1. FROM PETROLEUM: Liquid phase air oxidation of C5-C7 alkanes, obtainable from petroleum at high temperature and pressure will give C5-C7 carboxylic acids with methanoic, propanoic and butanoic acids as by-products.

C5-C7  O2/HIGH TEMPT. AND PRESSURE C5-C7 Carboxylic acid

1. SYNTHETIC PREPARATIONS
2. OXIDATION OF PRIMARY ALCOHOLS AND ALDEHYDES: Oxidation of primary alcohols and aldehydes can be used to obtain carboxylic acids using the usual oxidizing agents (i.e. K2Cr2O7 or KMnO4) in acidic solution.

RCH2OH KMnO4[O], excess acid RCHO [O] RCOOH

1. CARBONATION OF GRIGNARD REAGENT : Aliphatic carboxylic acids are obtained by bubbling CO2 into the Grignard reagent and then hydrolyzed with dilute acid.

RMgBr + CO2  (C2H5)2O RCOOMgBr H2O/dil.acid RCOOH + MgBrOH

R may be 10, 20 or 30 alkyl or aryl radical.

 In the preparation of benzoic acid, the reagent is added to solid CO2 (dry ice) which also serves as coolant to the reaction mixture.

C6H5MgBr + CO2 (C2H5)2O C6H5COOMgBr H2O/dil.acid C6H5COOH + MgBrOH

1. HYDROLYSIS OF NITRILES (CYANIDES) OR ESTERS: These hydrolysis reactions can take place in either acidic or basic medium. The mechanism for this reaction involves the formation of an amide followed by the hydrolysis of an amide to an acid.

RCN + 2H2O H+ RCOOH + NH4+

(R = alkyl or aryl radical)

RCOORI  H2O/H+ reflux RCOOH + RIOH

C6H5CH2CN + 2H2O H+ C6H5CH2COOH + NH4+

CH3CH2COOCH3 refluxH2O/H+ reflux CH3CH2COOH + CH3OH

1. REDUCTION :

4RCOOH + 3LiAlH4 (C2H5)2O (RCH2O)4 AlLi + 2LiAlO2 + 4H2

 4H2O

 4RCH2OH + Al(OH3) + LiOH

CH3CH2CH2COOH LiAlH4 CH3CH2CH2CH2OH

Butanoic acid Butanol

1. DECARBOXYLATION : CH3CH2CH2COONa + NaOH Fuse CH3CH2CH3  + Na2CO3

Kolbe Synthesis

2 CH3CH2CH2COONa + 2H2O CH3OHelectrolysis/aq. CH3(CH2)2CH3 + CO2 (anode) + 2NaOH + H2O (cathode)

1. ESTERIFICATION : CH3CH2CH2COOH + CH3CH2CH2OH H+ CH3CH2CH2COO- CH2CH2CH3 + H2O