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## DEPARTMENT; PHARMACY

## MATRIC NO.; 19/MHS11/130

## CHEMISTRY ASSIGNMENT 3

## HCOOH- Methanoic acid

## HOOCCH₂CH₂CH₂COOH- Pentan-1,5-dioic acid

## CH₃CH₂CH₂COOH- Butanoic acid

## HO₂C-CO₂H- Ethanedioic acid

## CH₃(CH₂)₄COOH- Hexanoic acid

## CH₃CH=CHCH₂CH₂COOH- Hex-4-eneoic acid

## Physical properties

1. **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 tempereature.
2. **Boiling points**- 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.
3. **Solubility**- lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are solble 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 molecular mass increases because the structure becomes relatively more hydrogencarbon in nature and hence covalent. All carbxylic acis are soluble in organic solvents.
4. **Industrial preparations**
5. **From carbon(ii)oxide**

Methanoic acid (formic acid) is manufactured by adding carbon(ii)oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is librerated by careful reactionn with tetraoxosulphate(vi0 acid (H₂SO₄)

NaOH H₂SO₄

CO ---------→ HCOONa ------→ HCOOH + NaHSO₄

1. **From ethanal**

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

dil. H₂SO₄/HgSO₄ O₂/(CH₃COO)₂Mn

HC ≡ CH ---------------------→ CH₃CHO ----------------------→ CH₃COOH

1. **Synthetic preparation**
2. **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 [O], excess acid/KMnO4 RCHO [O] RCOOH

**Ii. 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  (C2H5)2O RCOOMgBr H2O/ dil. acid RCOOH + MgBrOH

R may be 1o, 2o , 3o aliphatic alkyl or aryl radical In the preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to the reaction mixture

C6H5MgBr + CO2 (C2H5)2O C6H5COOMgBr H2O/H+ C6H5COOH + MgBrOH

**Iii. Hydrolysis of nitriles (cyanides) or esters**

RCN + 2H2O H+  RCOOH + NH4+

(R=alkyl or aryl radical)

RCOOR’ H2O/H+ reflux RCOOH + R’OH

C6H5CH2CN + 2H2O H+ C6H5CH2COOH + NH4+

CH3CH2COOCH3 H2O/H+ reflux CH3CH2COOH + CH3OH

1. **I. Reduction-**

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

4H2O

4RCH2OH + Al(OH)3 + LiOH

CH3CH2CH2COOH LiAlH4 CH3CH2CH2CH2OH

Butanoic acid Butanol

**Ii. Decarboxylation-**

CH3CH2CH2COONa + NaOH fuse CH3CH2CH3 + Na2CO3

Kolbe synthesis

2CH3CH2COONa + 2H2O electrolysis/aq. CH3OH CH3(CH2)2CH3 +CO2 (anode) + 2NaOH + H2(cathode)

**Iii. Esterification-**

CH3CH2CH2COOH + CH3CH2CH2OH H+  CH3CH2CH2COOCH2CH2CH3 + H2O.