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# DEPT: PHARMACY

***MAT NO: 19/MHS11/041***

***CHEM 102 ASSIGNMENT ON CARBOXYLIC ACIDS***

## *1*

***IUPAC NAMES FOR THE FOLLOWING COMPOUNDS***

*I, HCOOH: METHANOICACID*

*ii, HOOCCH2CH2CH2COOH: PETAN-1,5-DIOIC ACID* iii, CH3CH2CH2COOH: BUTANOIC ACID

*iv, HO2C-CO2H: ETHANEDIOICACID*

*V,CH3CH=CHCH2CH2COOH:HEX-4-ENEOICACID* VI, CH3[CH2]4COOH: HEXANOICACID

***2,***

### *PHYSICAL PROPERTIES OF CARBOXYLIC ACIDS*

***Physical appearances***

*AllsimplealiphaticcarboxylicacidsuptoC10areliquidsatroomtemperature.Most* othercarboxylicacidsaresolidatroomtemperaturealthoughanhydrouscarboxylic acid(aceticacid)alsoknownasglacialethanoicacidfreezestoanice-likesolidbelow the roomtemperature.

### *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.

### *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. 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.

### *3,*

***INDUSTRIAL PREPARATIONS***

*From Carbon(II) oxide*

*Methanoicacid(formicacid)ismanufacturedbyaddingcarbon(II)oxideunderpressure* to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by carefulreactionwithtetraoxosulphate(vi)acid(H2SO4)

*CO NaOH HCOONa H2SO4 HCOOH +NaHSO4*

*From ethanal*

*Ethanoicacidisobtainedcommerciallybytheliquidphaseair-oxidationof5%solution*

*ofethanaltoethanoicacidusingmanganite(II)ethanoatecatalyst.Ethanalitselfis* obtained fromethylene

*HC CH dil.H2SO4/HgSO4 CH3CHO O2/(CH3COO)2Mn CH3COOH*

### *4,*

***SYNTHETIC PREPARATIONS OF CARBOXYLICACIDS***

*Therearealotofwaystopreparethecarboxylicacidsynthetically,butIwilljuststate* twobrieflywiththerespectiveequations.

*Oxidation of primary alcohols and aldehydes*

*Oxidationofprimaryalcoholsandaldehydescanbeusedtopreparecarboxylic* acidsusingtheusualoxidizingagents(i.eK2Cr2O7orKMnO4)inacidicsolution

*RCH2OH [O], excessacid/KMnO4 RCHO [O] RCOOH* Hydrolysis of nitriles (cyanides) oresters

*RCN+2H2O H+ RCOOH + NH+*

*4*

*(R=alkyl or aryl radical)*

*RCOOR’ H2O/H+reflux RCOOH+R’OH* C6H5CH2CN+2H2O H+ C6H5CH2COOH + NH +CH3CH2COOCH3H2O/H+reflux CH3CH2COOH +CH3OH

*4*

### *5,*

***Reduction to primary alcohol***

*Carboxylic acids are very difficult to reduce by catalytic hydrogenation or dissolving* metals but lithium tetrahydridoaluminate (III) and diborane form intermediate compounds with the acids which liberate the alcohol on hydrolysis

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

*4RCH2OH+Al(OH)3+LiOH* CH3CH2CH2COOH LiAlH4 CH3CH2CH2CH2OH

*4H2O*

*Butanoicacid Butanol*

### *Decarboxylation*

*Thisinvolvesremovalofthecarboxylgroupfromtheacidtogiveahydrocarbonorits* derivatives.

*Thermal decarboxylation*

*Carboxylicacidswithastrongelectronattractinggroupeg–COOH,-CN,NO2,C=O* decarboxylatereadilyonheatingto100-150oCwhileothersdecarboxylatewhentheir saltsareheatedwithsodalime

*CH3CH2CH2COONa+NaOH fuse CH3CH2CH3 +Na2CO3*

*Kolbe synthesis*

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

### *Esterification*

*Inthepresenceofstrongacidcatalyst,carboxylicacidsreactwithalcoholstoform* esters

*CH3CH2CH2COOH+CH3CH2CH2OH H+ CH3CH2CH2COO CH2CH2CH3 +H2O.*