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Matric Number: 19/MHS03/007

Department: Anatomy

Course: CHM 102

College: MHS

CARBOXYLIC ACID ASSIGNMENT

1 IUPAC name for the following

HCOOH. = Methanoic acid

HOOCCH2CH2CH2COOH. = Butane 1,4 dioic acid

CH3CH2CH2COOH =. Butanoic acid

HO2C-CO2H. =. Ethane dioic acid

CH3(CH2)4COOH. = Hexanoic acid

CH3CH=CHCH2CH2COOH. = Hex-4-enoic acid

2. Discuss briefly the physical properties of carboxylic acids under the following headings

Physical appearance ii. Boiling point iii. Solubility

Physical appearance

1. All simple aliphatic carboxylic acids up to C10 are liquids at room temperature.
2. Most other carboxylic acids are solid at room temperature.

Boiling point

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. All carboxylic acids are soluble in organic solvents.

3. Write two industrial preparations of carboxylic acids

INDUSTRIAL PREPARATIONS

1. 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 liberated by careful reaction with tetraoxosulphate (vi) acid (H2SO4)

CO ​NaOH​​HCOONa ​H2SO4​​​HCOOH + NaHSO4

2. From ethanal

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

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

4. With equations and brief explanation discuss the synthetic preparation of carboxylic acid

SYNTHETIC PREPARATIONS

1. 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

2. 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

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

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

​​​​​​​​4H2O

​​​​​​4RCH2OH + Al(OH)3 +LiOH

CH3CH2CH2COOH ​​LiAlH4​​CH3CH2CH2CH2OH