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MATRIC NO: 17/ENG02/061 CHM 102 ASSIGNMENT

QUESTION 1

a. Suggest possible formulas for a molecular ion (m/z) of 105.

Step 1 – Since the mass of the molecular ion is odd it should contain at least 1 Nitrogen atom.

Relative atomic mass of Nitrogen = 14

Mass of Molecular ion – Mass of Nitrogen atom, 105 – 14 = 91

Step 2 – Determine the maximum amount of Carbon atoms.

91/12 = 7.58(7 is the maximum number of Carbon atoms.)

C7N is an incomplete formula.

Step 3 – Since 7 Carbon atoms x 12 = 84 and 1 Nitrogen atom = 14 , 84 + 14 = 98.

Add enough Hydrogen atoms to make up the rest of the mass.

Mass of Molecular ion – Mass of C7N , 105- 98= 7, there are 7 possible Hydrogen atoms. After adding 7 Hydrogen atoms, the result is C7NH7. ((12 x 7)+(14 x 1) +(7 x 1)) = 105.

Step 4 – Calculate the Degree Of Unsaturation ( Index Of Hydrogen Deficiency)

Using the formula, Index Of Hydrogen Deficiency(IHD) = (2(N)+2-M)/2, where n = number of carbon atoms and m = number of hydrogen atoms ,

(2(7.5) + 2 – 7)/2 = 5

 Structure of C7NH7

Step 5 – Add an Oxygen atom by removing 1 carbon atom and 4 Hydrogen atoms. Since the relative atomic mass of Carbon is 12 and Hydrogen is 4, 12+4=16. The relative atomic mass of Oxygen is also equal to 16.

Therefore,

C7NH7 will become C6NOH3

Step 6 - Calculate Degrees Of Unsaturation ( Index Of Hydrogen Deficiency)

Using the formula, IHD = (2(N)+2-M)/2 where n = number of carbon atoms and m = number of hydrogen atoms ,

(2(6.5) + 2 – 3)/2 = 6

Structure of C6NOH3

The possible formulas for a molecular ion of 105 are C7NH7 and C6NOH3 .

b. What are the importances of organic compounds?

i. Organic compounds play a vital role in supplying energy for our daily activities. Refined crude oil is separated into different fractions such as Kerosene, Diesel, Petrol. Kerosene is used as a jet fuel. Petrol and Diesel are used as a fuel for automobiles and generators.

ii. They constitute the majority of the food we eat. Carbohydrates, proteins and fats are also organic compounds and organic molecules make up a large portion of the human diet. Alcohols are also organic compounds.

iii. Most of the sterilizing agents and disinfectants like phenol, formaldehyde etc are organic compounds. Besides these solvents there are gases like ethylene oxide which are used for sterilization of drugs and manufactured substances.

iv. Organic compounds are also important in medicine and pharmacy. Drugs such as paracetamol, aspirin and antalgin are examples of organic compounds which are used for treatment of ailments.

v. In industries and labs, organic solvents such as ethers are widely used to clear of impurities. For example in drug extraction from plants, the fatty matter from the pulp is removed using petroleum ether.

c. Differentiate between homocyclic and heterocyclic compounds

Homocyclic compounds are **cyclic compounds that contain only atoms of carbon within their rings such as benzene and cyclopentane while** Heterocyclic compounds are the cyclic compounds in which the rings contain at least two different types of atoms (including a carbon atom) such as pyrrole and furan.

QUESTION 2

a. If the distance of the solvent front is 12.2 cm. 2.4cm, 5.6 cm and 8.9cm are distances of the different bands respectively. Calculate the Retardation factor of the available bands.

Using the formula,

Retardation factor = (Distance moved by the substance)/(Distance moved by the solvent front)

Retardation factor of Band 1, Rf1 = (2.4cm/12.2cm) = 0.20cm.

Retardation factor of Band 2, Rf2 = (5.6cm/12.2cm) = 0.46cm.

Retardation factor of Band 3, Rf3 = (8.9cm/12.2cm) = 0.73cm.

b. Two organic compounds were labelled A and B. A gave a positive test result (dark grey precipitate) to Tollens test and B decolourizes Bromine water. Suggest the family to which these organic compounds belong.

Organic Compound A is an ALDEHYDE.

Organic Compound B is a ALKENE.

c. 2,4-Dinitrophenylhydrazine test is employed for .............................................................

Detection of ALDEHYDES and KETONES.

d. List 7 functional groups of organic compounds giving two examples of each group.

FUNCTIONAL GROUPS EXAMPLES

1. Halo Group (RX) Chloroethane(C₂H₅CL), 1,1-Dichloroethane(C₂H₄CL₂)

2. Hydroxyl Group (ROH) Ethanol(C₂H₅OH), 1-propanol (CH₃CH₂CH₂OH)

3. Haloformyl group(RCOX) Butanoyl Chloride(C4H7ClO), Acetyl Iodide(C2H3IO)

4. Primary Amine Group(RNH₂) Methylamine(CH3NH2), Ethylamine(CH3CH2NH2)

5. Carbonyl Group(RCOR’) Butanone (CH3C(O)CH2CH3), Acetone ( (CH3)2CO )

6. Nitro Group(RNO₂) Nitromethane(CH3NO₂), 2-Nitropropane(C3H7NO2)

7. Carboxyl Group (RCOOH) Ethanoic Acid(CH3COOH), Propanoic acid(C₂H₅COOH)