**1a. Suggest possible formulas for a molecular ion (m/z) of 105?**

Note; if the mass of the molecular ion is odd it contains at least one N.

N = 14 amu 105 – 14 = 91

Determining the maximum number of carbon atom;

91/12 = 7.5 $C\_{7}NH$ ?

Add enough H’s to make up the rest of the mass;

$C\_{7}NH$ ? 7H’s gives $C\_{7}NH\_{7}$

 (2(7.5) + 2 - 7)/2 = 5

7 × 12 = 84

1 × 14 = 14

105 – (84 + 14) = 7

Also possibly one could and an Oxygen atom;

$C\_{7}NH\_{7}$ → $C\_{6}NOH\_{3}$

(2(6.5) + 2 - 3)/2 = 6

*Thus possible molecular formulas for a molecular ion (m/z) of 105 are*;

$C\_{7}NH\_{7}$ And $C\_{6}NOH\_{3}$

**1b. What are the importance of Organic compounds?**

Organic compounds play an important role in our daily activities. There is hardly any walk of life where we do not need the organic compounds. The food that we eat is essentially a mixture of organic compounds. The changes which the food undergoes in our bodies are organic chemical reactions. The clothes that we wear whether of cotton or synthetic fiber all are organic in character. The soap, cosmetics, perfume, oils, plastics, explosives, rubber, dyestuffs, paper, insecticides, etc., are all organic compounds. In the medicinal field, organic compounds are indispensable. Antibiotics, sulpha drugs, alkaloids, aspirin, iodoform, etc., are organic compounds. There is hardly any industry which is not dependent on organic compounds. The following list clearly illustrates the importance of organic compounds.

1. Food: Carbohydrate, Proteins, Fats, vitamins, Enzymes, etc.

2. Clothes: - Cotton, Silk, Wool, Nylon, Rayon, Dacron, etc.

3. Fuels: - coal, Wood, Natural gas, Petrol, etc.

4. Medicines: - Penicillin, Streptomycin, Chloromycetin, Sulphadiazine, Morphine, Aspirin, Iodoform, Cocaine, etc.

5. Explosives: - Nitroglycerine, Nitrocellulose, T.N.B, T. N.T, etc.

6. Dyes: - Indigo, Malachite green, Alizarin, etc.

7. Insecticides: - D.D.T, Gammexane, Malathion, etc.

8. Household and other common articles: - soaps, Cosmetics, Perfumes, Detergents, paper, Rubber, Plastics, Leather, Resins, Inks, Paints, Varnishes, Photographic films, etc.

**1c. Differentiate between homocyclic and heterocyclic compounds?**

|  |  |
| --- | --- |
| HOMOCYCLIC COMPOUNDS | HETEROCYCLIC COMPOUNDS |
| Homocyclic compounds are cyclic compounds having atoms of the same element as ring members. | Heterocyclic compounds are cyclic compounds having atoms of the different element as ring members including carbon atoms. |
| Homocyclic Compounds have 100% carbon atoms in their ring. | Heterocyclic Compounds have mainly carbon and, in addition, heteroatoms such as nitrogen, oxygen, and sulphur are found in their ring. |
| Sub division; Alicyclic homocyclic and Aromatic homocyclic. | **Sub division;** Alicyclic heterocyclic and Aromatic heterocyclic. |
| Examples; Phenol, Toluene, Naphthalene, and Anthracene. | **Examples;** Tetrahydrofuran, Piperidine, Pyridine, Furan, and Pyrrole. |

Based on the nature of the ring structure, cyclic organic compounds are classified as homocyclic compounds, in which the ring consists of only one type of atom, and heterocyclic compounds, in which the ring consists of at least two different types of atoms including carbon. In heterocyclic compounds, carbon atoms make the major portion of the ring, while the rest is made by heteroatoms, which often includes nitrogen, oxygen, and sulphur. This is the difference between homocyclic compounds and heterocyclic compounds.

**2a. If the distance of the solvent front is 12.2cm. 2.4cm, 5.6cm, and 8.9cm are distances of the different bands respectively. Calculate the Retardation factor of the available bands.**

Solvent front = 12.2 cm

$Rf$ = $\frac{distance moved by substance}{distance moved by solvent front}$

$Rf\_{a}$ = $\frac{2.4cm}{12.2cm}$ = 0.196

$Rf\_{b}$= $\frac{5.6cm}{12.2cm}$ = 0.459

$Rf\_{c}$ = $\frac{8.9cm}{12.2cm}$ = 0.729

**2b. Two organic compounds were labeled A and B. A gave a positive test result (dark grey precipitate) to Tollens test and B decolorizes Bromine water. Suggest the family to which these organic compounds belong.**

Compound A belongs to the **aldehyde** family.

Compound B belongs to the **alkene or alkyne (unsaturated compound)** family.

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

2, 4-Dinitrophenylhydrazine test is employed for qualitatively detecting the carbonyl functionality of a ketone or aldehyde functional group. A positive test is signaled by the formation of a yellow, orange or red precipitate (known as a dinitrophenylhydrazone).

 **2d. List 7 functional groups of organic compounds giving two examples of each group.**

|  |  |  |
| --- | --- | --- |
| FUNCTIONAL GROUP | HOMOLOGOUS SERIES | EXAMPLES |
|  |  |  |
| R-H | Alkanes | Propane and Octane |
| R-X | Haloalkanes | Iodoethane and 2-chloropropane  |
| R-OH | Alkanols | Ethanol and Propanol |
| R-COOH | Carboxylic acids | Ethanoic acid (Acetic acid) and Butanoic acid |
| R-COOR’ | Esters | Ethyl Ethanoate and Methyl Ethanoate |
| R-O-R’ | Ethers | Dimethyl ether (Methoxymethane) and Diethyl ether (Ethoxyethane). |
| R-$NH\_{2}$ | Amines | Phenylamine (aniline) and Methylamine |