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College: ENGINEERING
Course Code: CHEM 102 Course Title: General Chemistry II**

**ASSIGNMENT ANSWERS**

**Question 1**

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

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**Fragment at m/z =105
Step1- if the mass of the molecular ion is odd it contains at least one nitrogen N= 14 atoms
105-14=91
Step2- determine max NC’S**$\frac{91}{12 } $**= 7.5** $C\_{7}HN$**?
Sep3- add enough H’s to make up the rest of the mad
7×12=84
1×14=14
105-(84+14) =7
7H’S gives** $C\_{7}NH\_{7}$

**Step 4- check for the presence of multiple bonds
(2n+2-7)/2= 2(7.5) +2-7/2 =5.25
Step4- add an O atom**$C\_{7}NH\_{9 }\rightarrow C\_{6}H\_{3}NO$$C\_{7}H\_{7}N$**- Azocine** $C\_{6}H\_{3}NO- $**Pyran-3-carbonitrile**$\frac{(2\left(6.5\right)) + (2-3) }{2}$ **= 5.5 ~ 6**

**Other formula include;**

$C\_{8}H\_{9}$ **– 2-Phenylethyl**

1. **What are the importance of organic compounds. 1- In nucleic acids: Nucleic acids are essential biopolymers for all life forms (DNA is included in this category).They are composed of many elements but mainly coal and hydrogen, although there are also oxygen atoms in their sugars.Nucleic acids are the most important of all biomolecules. They are found in abundance in all living things, where their function is to create and encode, and then to store information in the nucleus of all living cells of all living organisms on Earth.**

**2- In carbohydrates: A carbohydrate is a biological molecule consisting of carbon, hydrogen, and oxygen. In biochemistry, the term is synonymous with a group of elements that may include sugars, celluloses and starch.Carbohydrates play an important role in living organisms. Polysaccharides serve to store energy and as structural components in plants and arthropods, for example.In general, saccharides and their derivatives include many other important biomolecules that play primordial roles in the immune system, in fertilization, in blood clotting, and in the prevention of pathogenesis.In food science, the term carbohydrate can be used to define any food that is rich in complex carbohydrate starches such as cereals, pasta, bread, or rich in simple carbohydrates such as candies or sweets.**

**3- As the basis of food: Food materials are created from carbon compounds via carbohydrates, proteins and fats. All the food we consume is reconstituted material and extracts of plants or animals.Organic molecules make up a large portion of the human diet and are found in all food consumed by an individual.It requires a large number of organic molecules needed to keep cells and tissues healthy.**

**4- In lipids: A Lipid Is a term used to define substances of biological origin that are soluble in solvents.It consists of a group of molecules that occur in nature like fats, waxes, sterols, monoglycerides and triglycerides, among others.The main functions of lipids include storing energy, signaling lipid and acting as a structural component of cell membranes.Lipids have applications in the cosmetics industry and in the food industry, as well as nanotechnology.**

**5- In metabolism: The three main purposes of metabolism are energy / fuel conversion as energy for cellular processes, energy / fuel conversion to build blocks for proteins, lipids, nucleic acids, and some carbohydrates, as well as the elimination of nitrogenous waste.These reactions allow organisms to grow and reproduce, maintain their structures, and respond to the environment.Metabolism is usually divided into two categories: catabolism, which is the decomposition of organic matter and the breakdown of glucose by cellular respiration; And in anabolism, which is the construction of components of cells such as proteins and nucleic acids.**

**6- In proteins: One type of organic molecule that must be present in every human's diet is protein. Proteins are composed of chains of organic molecules called amino acids.The human body uses a combination of 20 different types of amino acids, arranged in specific sequences to make thousands of unique human proteins present in cells and tissues.Protein is important in a diet to provide a source of amino acids - protein is broken down inside the stomach and intestines - and the amino acids that make up the diet protein are absorbed inside the body and are used to make their own proteins .**

**7- Hydrocarbons: Hydrocarbons are organic compounds that are made up entirely of hydrogen and carbon.There are many different types of hydrocarbons such as methane, ethane, propane, pentane and octane, among others.Most of the hydrocarbons found on Earth occur naturally in the Crude oil , Where the decomposed organic matter provides an abundance of coal and hydrogen, which, when joined, can be chained to form unlimited chains.Hydrocarbons are the primary source of energy for most civilizations today. The prominent use of hydrocarbons is as a source of fuel. In their solid form hydrocarbons can take the form of asphalt.The use of hydrocarbons is also prevalent in nature. Some arthropods, such as the Brazilian bee, use particular hydrocarbon smells to differentiate members of their family for example.**

1. **Differences between homocyclic compounds and heterocycliccompounds**

 **The key difference between homocyclic compounds and heterocyclic compounds is that in homocyclic compounds, the ring of homocyclic compounds is made up carbon atoms only, whereas that of heterocyclic compounds is made up of more than one kind of atoms.Homocyclic or carbocyclic compounds contain rings which are made up of only one kind of atoms, i.e., carbon atoms.Cyclic compounds that contain one or more atoms other than that of carbon atoms in their rings are called heterocyclic compounds.**

**Question 2**

1. **Retardation Factor,** $R\_{f}$ **=** $\frac{Distance moved by substance}{Distance moved by the solvent front}$

**For Distance moved in 2.4cm,** $R\_{f}=\frac{2.4}{12.2}=0.197$$\~ 0.20$

**For Distance moved in 5.6cm,** $R\_{f}=$$\frac{5.6}{12.2 }=0.459 \~ 0.50$

**For Distance moved in 8.9cm,** $R\_{f}= \frac{8.9}{12.2}=0.729 \~ 0.73$

1. **Two organic compounds were labelled A and B. A gave a positive test result (dark grey precipitate) to Tollen’s test and B decolorizes Bromine water. Suggest the family to which these organic compounds belong.**

**Compound A – Aldehydes**

**Compound B – Unsaturated compound i.e. Alkene (Alkynes does not react with bromine water)**

1. **2, 4-Dinitrophenylhydrazine test is employed for the qualitative test for [carbonyl groups](https://en.wikipedia.org/wiki/Carbonyl_group%22%20%5Co%20%22Carbonyl%20group) associated with [aldehydes](https://en.wikipedia.org/wiki/Aldehyde%22%20%5Co%20%22Aldehyde) and [ketones](https://en.wikipedia.org/wiki/Ketone%22%20%5Co%20%22Ketone).2,4-Dinitrophenylhydrazine is a red to orange solid. 2, 4-Dinitrophenylhydrazine is commercially available usually as a wet powder and is often used to qualitatively test for [carbonyl groups](https://en.wikipedia.org/wiki/Carbonyl_group%22%20%5Co%20%22Carbonyl%20group) associated with [aldehydes](https://en.wikipedia.org/wiki/Aldehyde%22%20%5Co%20%22Aldehyde) and [ketones](https://en.wikipedia.org/wiki/Ketone%22%20%5Co%20%22Ketone). 2, 4-Dinitrophenylhydrazine can be used to qualitatively [detect](https://en.wikipedia.org/wiki/Chemical_test%22%20%5Co%20%22Chemical%20test) the carbonyl functionality of a [ketone](https://en.wikipedia.org/wiki/Ketone%22%20%5Co%20%22Ketone) or [aldehyde](https://en.wikipedia.org/wiki/Aldehyde%22%20%5Co%20%22Aldehyde) functional group. A positive test is signaled by the formation of a yellow, orange or red [precipitate](https://en.wikipedia.org/wiki/Precipitate%22%20%5Co%20%22Precipitate) (known as a [dinitrophenylhydrazone](https://en.wikipedia.org/w/index.php?title=Dinitrophenylhydrazone&action=edit&redlink=1" \o "Dinitrophenylhydrazone (page does not exist))). If the carbonyl compound is aromatic, then the precipitate will be red; if aliphatic, then the precipitate will have a more yellow color.**
2. **List 7 functional groups of organic compounds giving two examples of each group?**

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| --- | --- | --- |
| **Functional Group** | **General Formula** | **Examples** |
| **Alkanoic Acid**  | **R-COOH**  | $CH\_{3}COOH $**– Ethanoic Acid**$C\_{3}H\_{7}COOH-$ **Butanoic Acid** |
| **Alkanol**  | **R-OH** | $CH\_{3}OH- $**Methanol**$C\_{2}H\_{5}OH- $**Ethanol** |
| **Alkyl-Halide** | **RX****(X includes the halides such as Fluorine, Chlorine, and Bromine etc.)** | $CH\_{3}Cl-$**Chloromethane**$C\_{3}H\_{7}Br- $**Bromopropane** |
| **Alkanal** | **R-COH** | $CH\_{3}COH- $**Ethanal**$C\_{2}H\_{5}COH- $**Propanal** |
| **Esters** | **R**$-COÒ\acute{R}$ | $C\_{2}H\_{5}COOCH\_{3 }– $**Methylpropanoate**$C\_{3}H\_{7}COOC\_{2}H\_{5 }–$ **Ethylbutanoate** |
| **Ketones/Alkanones**  | **R**$-C=O\acute{R}$ | $CH\_{3}COCH\_{3 }–$ **Propan-2-one** $CH\_{2}OCH-\_{ }$**Ethanone** |
| **Amides**  | $$R-CONH\_{2}$$ | $CH\_{3}CONH\_{2}$ **– Acetamide**$ C\_{2}H\_{5}CONH\_{2}- $**Propanamide** |