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Department: MECHANICAL ENGINEERING

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

**ASSIGNMENT SOLUTIONS**

**Question 1**

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



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 $C\_{7}NH\_{7}$
(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?

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.

* **Food**: Carbohydrate, Proteins, Fats, vitamins, Enzymes, etc.
* **Clothes**: - Cotton, Silk, Wool, Nylon, Rayon, Dacron, etc.
* **Fuels**: - coal, Wood, Natural gas, Petrol, etc.
* **Medicines**: - Penicillin, Streptomycin, Chloromycetin, Sulphadiazine, Morphine, Aspirin, Iodoform, Cocaine, etc.
* **Explosives**: - Nitroglycerine, Nitrocellulose, T.N.B, T. N.T, etc.
* **Household and other common articles**: - soaps, Cosmetics, Perfumes, Detergents, paper, Rubber, Plastics, Leather, Resins, Inks, Paints, Varnishes, Photographic films, etc.
1. Differences between homocyclic compounds and heterocyclic compounds

Organic compounds are widely classified into two sections based on their carbon framework, namely open-chain compounds, and closed chain or cyclic compounds. Open chain compounds are again subdivided into two groups; unbranched chain and branched chain compounds. Closed chain or cyclic compounds are also subdivided into two groups; homocyclic and heterocyclic compounds. 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 compounds*** are also known as ***carbocyclic compounds*** or ***isocyclic compounds*** as their rings are formed with only one type of atoms, mainly carbon. Homocyclic compounds can be further classified into alicyclic compounds and arenas or [aromatic compounds](http://www.differencebetween.com/difference-between-aromatic-and-vs-aliphatic/).
***Heterocyclic compounds*** are the cyclic compounds in which the rings contain at least two different types of atoms (including a carbon atom). The atoms other than the carbon atoms present in the ring are known as **heteroatoms**. Usually, the rings of these compounds consist of a larger portion of carbon. The most common heteroatoms present in heterocyclic compounds include nitrogen, sulphur, and oxygen. Heterocyclic compounds can be either aromatic or aliphatic.

**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, Ketones and Terminal Alkynes*

*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 the [chemical compound](https://en.wikipedia.org/wiki/Chemical_compound%22%20%5Co%20%22Chemical%20compound) C6H3(NO2)2NHNH2. *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?

|  |  |  |
| --- | --- | --- |
| 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 |