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COLLEGE: SCIENCES

DEPARTMENT: GEOLOGY

COURSE: CHM 102

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

(m/z) = 105

If the mass of the molecular ion is odd, it contains at least one Nitrogen (N)

N = 14amu

105-14 = 91

Step 1: Determine the maximum number of Carbon atoms

$\frac{91}{12}$ = 7.5

C7NH?

Step 2: Add enough Hydrogen to make up to the rest of the mass

C7NH? = 105 (C=12, N=14, H=1)

C = 12 x 7 = 84

N= 1x14= 14

H = 105 – (84+14) = 7

C7NH7

Step 3: Find the IHD (Index of Hydrogen Deficiency)

IHD = $\frac{2n+2-H}{2}$

I.e. IHD = $\frac{2\left(7.5\right)+2-7}{7}$ = 5

Which means it can have 5 double bonds or rings or triple bonds

Step 4: Add an Oxygen atom to the formula

C7NH7 = C? NOH? (C=12, N=14, H=1, O=16)

105-(14+16) = 75

$\frac{75}{12}$ = 6.25 i.e. there is a maximum of 6 carbon atoms in this compound

6 x 12= 72

 i.e. the remaining which is the hydrogen atom

= 75 – 72 = 3

C6NOH3

IHD = $\frac{2\left(6.25\right)+2-3}{2}$ = 5.75

b) What are the importance of organic compounds?

**Food**: Food materials are solely made of carbon compounds e.g. Carbohydrates (CHO), Proteins (NH2-CH-COOH) and Fats (CH-COO-CH). Even Vitamins are organic in nature. Among beverages Alcohol is an organic substances.

**Medicine**: Medicine is the prime store of organic compounds. Though not all but many medicines are made of organic substances. Like [antibiotics](https://www.studyread.com/antibiotics-definition-function-mechanism/), anticancer drugs, painkillers, anti-depressant, anesthetics etc.

**Valuables**: Diamonds, graphite, petroleum. Interestingly the carbon compounds are found to be highly valuable, durable and hardest in the world. Diamond and graphite are both pure carbon alone compound without any other elements inside. They are both highly used and expensive. Their properties are studies in organic chemistry. Petroleum is the other most valued resources on the earth for fuels needs in the world. These petroleum products are further diversified for various uses. And petroleum is one of the factors which influence the world economy.

**Cleansing agents:**In industries and labs, organic [solvents](https://www.studyread.com/examples-of-solvents/)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. Thus organic chemistry through its knowledge of polarity, solubility, partition factors uses solvents to separate components for better use.

It is also important in the production of clothes, explosives, dyes and insecticides.

c) Differentiate between homocyclic and heterocyclic compounds

 Homocyclic compounds are those that have atom belonging to the same elements in the ring while heterocyclic compounds are those that have atoms of different elements including carbon in a ring.

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

RF (Retardation Factor) = $\frac{Distance moved by the band}{Distance moved by the solvent front}$

Distance moved by the solvent front = 12.2cm

First band = 2.4cm

RF = $\frac{2.4}{12.2}$ = 0.197

Second band = 5.6cm

RF = $\frac{5.6}{12.2}$ = 0.459

Third band = 8.9cm

RF = $\frac{8.9}{12.2}$ = 0.730

b) Two organic compounds were labelled 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.

 A is an **aldehyde** which gave a positive test result (dark grey precipitate)

 B is an **alkene** which decolorizes bromine water.

c) 2, 4- Dinitrophenylhydrazine test is employed for **Ketones and Aldehydes**

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

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| --- | --- | --- | --- |
| Organic Compounds | General Formula | Functional Group  | Examples |
| Alkanes | CnH2n+2 |  C - C | Methane & Butane |
| Alkenes | CnH2n |  C=C | Ethene & Pentene |
| Alkanols/ Alcohols | ROH |  -OH | Ethanol & Propanol |
| Alkanals/ Aldehydes | RCHO |  -CHO | Methanal & Ethanal |
| Alkanones/ Ketones | RCOR |  -C=O | | Pentanone& Propanone  |
| Alkanoates/ Esters | RCOOR’ |  -C=O | OR | Ethanoate & Propanoate |
| Amines | RNH2 |  -NH2 | Methylamine & Ethylamine |

Where R= CnH2n+1