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QUESTION 1

a) The rule of 13 states that the formula of a compound is a multiple ‘n’ of 13 (the molar mass of CH) plus a remainder ‘r’.

According to the rule of 13, n = $\frac{molecular ion}{13}$ = $C\_{n}H\_{n+r}$

If one has heteroatoms, adjust the formula

* For O, add O and subtract $CH\_{4}$
* For N, add N and subtract $CH\_{2}$
* Or Cl, add Cl and subtract $C\_{2}H\_{11}$

 $∴n=\frac{105}{13}$ = 8 r 1

 n = 8, r = 1

Using$ C\_{n}H\_{n+r}$, formular = $C\_{8}H\_{9}$ (i)

* $C\_{7}H\_{5}O$ (ii)
* $C\_{6}HO\_{2}$ (iii)
* $C\_{7}H\_{7}N$ (iv)
* $C\_{6}H\_{9}N\_{2}$ (v)
* $C\_{5}H\_{3}N\_{3}$ (vi)
* $C\_{4}HN\_{4}$ (vii)
* $C\_{6}H\_{3}NO$ (viii)

b) Organic compounds are important because;

They serve as the basis of all carbon-based life on Earth (i.e. living organisms)

They have versatile bonding patterns and are part of all organisms.

Carbohydrate is a biological molecule, consisting of carbon, hydrogen and oxygen and carbohydrate plays an important role in living organisms

They make up a large portion of the human diet and are found in all food consumed by an individual.

Hydrocarbons are the primary source of energy for most countries today.

Clothing industries use organic compounds to produce; cotton, silk, wool, nylon, etc.

They are used to produce household and other common materials such as; detergents, cosmetics, perfumes, plastic, paint, photographic films, etc.

They are used to produce explosives such as nitroglycerine, nitrocellulose, etc.

c)

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| Properties | Homocyclic Compounds | Heterocyclic Compounds |
| Atomic structure | i) They are compounds having atoms of the same element as ring members.  | i) They are compounds having atoms of the different elements as ring members including carbon atom. |
| Ring formation | ii) They contain atoms of the same element bonded to each other forming a ring. | ii) They contain atoms of at least two different elements bonded to each other forming a ring. |
| Atomic composition of rings | iii) The rings contain atoms of the same element. | iii) The rings contain atoms of different elements. |
| Sub-divisions | iv) Alicyclic homocyclic and aromatic homocyclic. | iv)Alicyclic heterocyclic and aromatic heterocyclic. |
| Examples | v) Benzene, cyclohexane, toluene, etc.  | v) Pyran. azocine, thiocane, etc. |

QUESTION 2

a) Retardation factor (Rf) = $\frac{distance moved by substance}{distance moved by solvent front}$

 Rf of 2.4cm band = $\frac{2.4cm}{12.2cm}$ = 0.197

 Rf of 5.6cm band = $\frac{5.6cm}{12.2cm}$ = 0.459

 Rf of 8.9cm band = $\frac{8.9cm}{12.2cm}$ = 0.730

b) A belongs to the aldehyde family while, B belongs to the alkene family.

c) Aldehydes and Ketones

d) Alkane – eg; methane, pentane

 Alkene – eg; butene, octene

 Aldehyde – eg; formaldehyde, cinnamaldehyde

 Alkanone/ketones – eg; buta-2-one, propanone

 Carboxylic acid – eg; 2-methylpentanoic acid, ethanoic acid

 Ethers – eg; ethoxyethane, methoxyethane

 Esters – eg; propyl methanoate, methyl butanoate