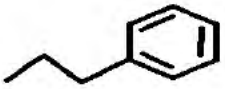
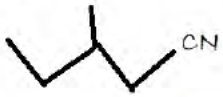
UNIT 12

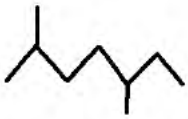
ORGANIC CHEMISTRY- SOME BASIC PRINCIPLES AND TECHNIQUES

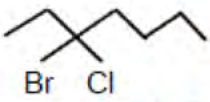
Questions carry 1 scores for each subdivision

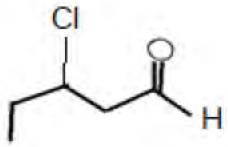
1. Give the IUPAC names of the following compounds

a) 

B) 

c) 

d) 

e) 

Answer

a) propylbenzene

b) 3-methylpentanenitrile

c) 2,5-dimethylheptane

d) 3-bromo-3-chloroheptane

e) 3- chloropentanal

2.Which of the following represents the correct IUPAC names for the compounds concerned?

a) 2,2-Dimethylpentane **or** 2-Dimethylpentane

b) 2,4,7-Trimethyloctane **or** 2,5,7-Trimethyloctane

c) 2-chloro-4-methylpentane **or** 4-chloro-2-methylpentane

d) But-3-yn-1-ol **or** But-4-ol-1-yne

Answers

a) The prefix' di" shows that there are two methyl groups in the chain .thus the correct IUPAC name would be 2,2-Dimethylpentane

b) the locant number should start from the minimum .Here 2,4,7 is lower than 2,5,7.thus the correct IUPAC name would be 2,4,7-Trimethyl octane

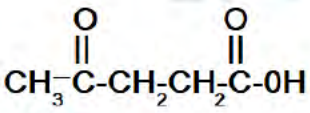
c) if the substituents in the chain are in equivalent positions ,then the lower member is given alphabetical order .thus the correct IUPAC name would be 2- chloro-4-methylpentane

d) out of the 2 functional groups present in the given compound, the alcoholic group is the principal functional group thus the parent chain will have an – ol suffix ,the IUPAC name would be But-3-yn-1-ol

3) which of the following is the correct IUPAC name?

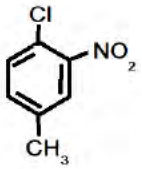
a) 3-Ethyl-4,4-dimethylheptane
b) 4,4-Dimethyl-3-ethylheptane
c) 5-Ethyl-4,4-dimethylheptane
d) 4,4-Bis(methyl)-3ethylheptane

Ans: a

4) The IUPAC name for 

a)1-hydroxypentane-1,4-dione
b)1,4-dioxopentanol
c) 1-carboxybutane-3-one
d) 4-oxopentanoicacid

Ans: d

5) The IUPAC name for 

a) 1-chloro-2-nitro-4-methylbenzene
b) 1-chloro-4-methyl-2-nitrobenzene
c) m-Nitro-p-chlorotoluene

Ans: b

6) In which of the following functional group isomerism is not possible ?

a) Alcohols

b) Aldehydes

c) Alkyl halides

d) Cyanides

Ans :Alkyl halides

7. What is homologous series?

Ans. A series of organic compounds in which adjacent members are differed by a $-CH_2$ group is called a homologous series. They show a regular gradation in physical and chemical properties and represented by a general formula. They will have a common functional group.

8. Give the chemical name of the compound responsible for the blue colour in the Lassaigne's test for nitrogen.

Ans. Ferricferrocyanide **or** Iron (III) hexacyanoferrate (II) **or** Prussian blue

9. . C_2H_6 and C_5H_{12} are members of a homologous series. What is the general molecular formula of this homologous series?

Ans: C_nH_{2n+2}

Answer the Questions (2 scores each)

10. Consider structures i to vii and answer for the following questions

i. $CH_3-CH_2-CH_2-CH_2-OH$

ii. $CH_3-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$

iii $CH_3-\underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3$

iv $CH_3-\overset{\displaystyle CH_3}{\overset{|}{CH}}-CH_2-OH$

v $CH_3-CH_2-O-CH_2-CH_3$

vi $CH_3-O-CH_2-CH_2-CH_3$

vii $CH_3-O-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

A) Which of the above pairs form metamers?

Ans. Pairs v and vi form pairs of metamers. (Metamers of ethers). Here in compounds V and vi, the chain length is the same but the distribution of carbon is different (length of alkyl group) on both the sides of functional group ie, oxygen.

B) Identify the pairs of compounds which are functional group isomers?

Ans. I and v, i and vii, ii and v, ii and vi, ii and vii, iii and v , iii and vi, iii and vii, iv and v, iv and vi, iv and vii.

Alcohols are functional group isomer with ethers.

C) Identify the compound represent position isomers.

Ans. : I and ii, ii and iv, v and v are the position isomers. Position isomers are compounds having same molecular formula and same functional group, but the position of functional group will be different.

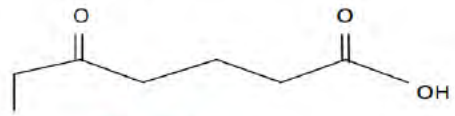
E) Identify the pairs of compounds that are chain isomers.

Ans. I and iii, i and iv, ii and iii, ii and iv, v and vii, vi and vii are the chain isomers. Compounds having same molecular formula but differ in the length of carbon chain are called chain isomers.

11. Name the compound whose structure are given.

i) CH_3-CH_2-CH-CH(CH_3)-CH_2-CH_3
CH_2-CH_3

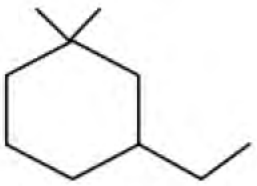
ii)



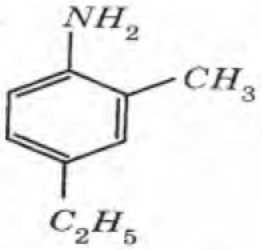
Ans: i) 3-Ethyl-4-methylhexane ii) 5-Oxoheptanoic acid

12. Give IUPAC name of

1)



2)



Ans: 1) 3-Ethyl-1,1-dimethylcyclohexane

2) 4-Ethyl-2-methylaniline

13. Write the structural formula of the following compounds:

i) Pent-4-en-2-ol
ii) 6-Hydroxyheptanal
iii) 2,4,7 – Trimethyloctane
iv) 2-Chloro-4-methylpentane

Ans)

(i) $CH_2 = CH - CH_2 - CH(OH) - CH_3$

(ii) $CH_3\text{-}CH(OH)\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CHO$

(iii) $CH_3\text{-}CH(CH_3)\text{-}CH_2\text{-}CH(CH_3)\text{-}CH_2\text{-}CH_2\text{-}CH(CH_3)\text{-}CH_3$

(iv) $CH_3\text{-}CH(Cl)\text{-}CH_2\text{-}CH(CH_3)\text{-}CH_3$

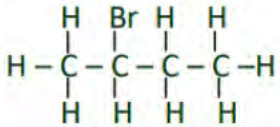
14. The bond-line formula of a compound is given below.

Write its condensed formula and give the IUPAC name.

Ans: $HO\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH(CH_3)\text{-}CH(CH_3)\text{-}CH_3$

IUPAC Name: 4,5-Dimethylhexan-1-ol

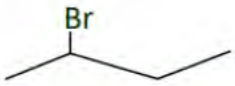
15. Write the complete, condensed and bond line structural formulae of 2-bromobutane.



Complete structural formula

$CH_3\text{-}CH(Br)\text{-}CH_2\text{-}CH_3$

Condensed structural formula



Bond line formula

16. What is 'sodium fusion extract'? How the presence of Nitrogen in organic compounds detected?

Ans: Nitrogen present in an organic compound is detected by "Lassaigne's test". Here the organic compound is fused with metallic sodium in a fusion tube. It is then plunged into distilled water taken in a china dish. The solution is boiled and filtered. The filtrate is known as sodium fusion extract.

To one part of sodium fusion extract add freshly prepared ferrous sulphate ($FeSO_4$) solution. It is heated to boiling, cooled and acidified with dil. H_2SO_4 . If Blue or green colouration or precipitate observed, the compound contains Nitrogen.

Answer the Questions (4 scores each)

17. Briefly explain the different types of structural isomerism shown by organic compounds with suitable examples.

Ans:

There are mainly four types of structural isomerism:

a) Chain Isomerism: Isomers differ in carbon chain or skeleton are called chain isomers and the phenomenon is called chain isomerism.

E.g.: Pentane (C_5H_{12})

$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$
normal pentane

$CH_3 - CH(CH_3) - CH_2 - CH_3$
iso pentane

$CH_3 - C(CH_3)_2 - CH_3$
Neo pentane

b) Position isomerism: Isomers which differ in the position of the substituent or side chain are called position isomers and the phenomenon is called position isomerism.

E.g. : Alcohol with molecular formula $C_4H_{10}O$ may be 1-butanol or 2-butanol

c) Functional group isomerism: Isomers which differ in the functional group are called functional group isomers and the phenomenon is called functional group isomerism. This isomerism is shown by alcohols and ethers and aldehydes and ketones.

E.g. compound with the molecular formula C_2H_6O may be an alcohol ethanol (CH_3-CH_2OH) or an ether methoxymethane (CH_3-O-CH_3).

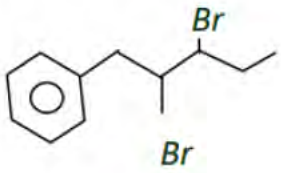
b) Metamerism: Isomers which differ in the carbon chain (alkyl groups) around the functional group are called metamers and the phenomenon is called metamerism. It is commonly shown by ethers. E.g.: Ether with molecular formula $C_5H_{12}O$ may be methoxybutane (CH_3-O-CH_2-CH_2-CH_2-CH_3) or ethoxypropane (CH_3-CH_2-O-CH_2-CH_2-CH_3).

18. a) Draw the structures of the following compounds.

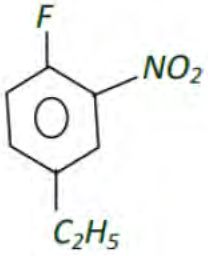
i) 2,3-Dibromo-1-phenylpentane ii) 4-Ethyl-1-fluoro-2-nitrobenzene

b) Write all the possible chain isomers of the compound with molecular formula C_5H_{12}.

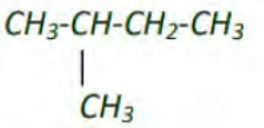
Ans: a) i)



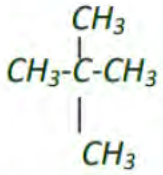
ii)



b) CH_3-CH_2-CH_2-CH_2-CH_3 ,



and



19. How can you detect the presence of carbon and Hydrogen in an organic compound?

Ans. : Organic compound is heated with copper (II) oxide [CuO]. Carbon present in the compound is oxidised to carbon dioxide and hydrogen to water. CO_2 can be tested by passing through lime-water, which turns milky and water can be tested with anhydrous copper sulphate, which turns blue.

$$C + 2CuO \xrightarrow{\Delta} 2Cu + CO_2$$

$$2H + CuO \xrightarrow{\Delta} Cu + H_2O$$

$$CO_2 + Ca(OH)_2 \quad CaCO_3\downarrow + H_2O$$

$$5\,H_2O + CuSO_4 \quad CuSO_4\,5\,H_2O$$

White Blue