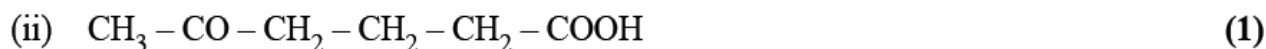
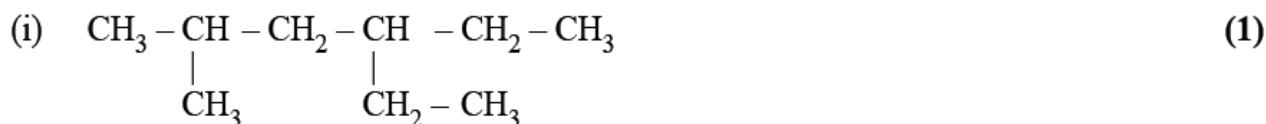


PREVIOUS HSE QUESTIONS AND ANSWERS OF THE CHAPTER “ORGANIC CHEMISTRY – SOME BASIC PRINCIPLES AND TECHNIQUES”

1. Write the IUPAC names of the following :



Ans: (i) 4-Ethyl-2-methylhexane

(ii) 5-Oxohexanoic acid

2. Write the differences between homolytic and heterolytic bond cleavages. (2)

Ans:

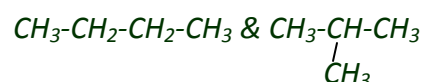
Homolytic bond cleavage (Homolysis)	Heterolytic bond cleavage (Heterolysis)
Here each of the bonded atoms gets one of the electrons of the shared pair.	Here, the bond breaks in such a manner that the shared pair of electrons remains with one of the parts.
Movement of a single electron occurs.	Movement of a pair of electrons occurs.
The species formed as a result of homolysis is called free radical .	As a result of heterolysis, carbocations or carbanions may be formed in the case of organic compounds.

3. (i) Differentiate chain isomerism from position isomerism. (2)

(ii) Write the structures of all the possible position isomers of butanol ($\text{C}_4\text{H}_{10}\text{O}$). (1)

Ans: (i) Isomers which differ in the carbon chain (C skeleton) are called chain isomers.

E.g. Position isomers of C_4H_{10} are

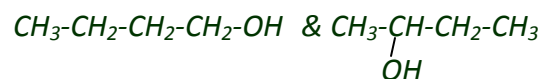


Isomers which differ in the position of substituent or functional group are called position isomers.

E.g. 2-methylpentane and 3-methylpentane



(ii) Position isomers of butanol are:



Butan-1-ol

Butan-2-ol

4. Explain the detection of nitrogen present in an organic compound by Lassaigne's test. (3)

[December 2021]

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. Heated to boiling, cooled and acidified with dil. H_2SO_4 . Blue or green coloration or precipitate indicates the presence of Nitrogen.

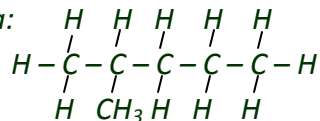
5. Write the position isomers of an alcohol with molecular formula $\text{C}_3\text{H}_8\text{O}$. (2)

Ans: The position isomers are:

$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$ (Propan-1-ol) and $\text{CH}_3\text{-CHOH-CH}_3$ (Propan-2-ol)

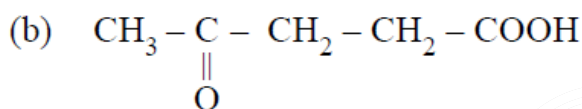
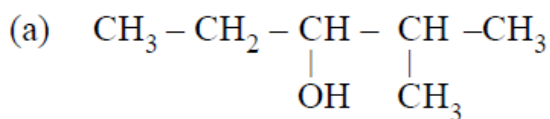
6. Write the complete structural formula and condensed structural formula of 2-Methyl pentane. (2)

Ans: Complete structural formula:



Condensed structural formula: $\text{CH}_3\text{-}\underset{\text{CH}_3}{\text{CH}}\text{-CH}_2\text{-CH}_2\text{-CH}_3$

7. (i) Write IUPAC names of the following :



(2)

- (ii) Identify groups with +R electron displacement effect from the following:

- Cl, - COOH , - NO_2 , - NH_2

(1)

Ans: (i) (a) 2-Methylpentan-3-ol

(b) 4-Oxopentanoic acid

(ii) +R effect groups: -Cl & - NH_2

8. (i) Name any two elements detected by Lassaigne's test. (2)
(ii) Write two differences between Homolysis and Heterolysis. (2) [September 2021]

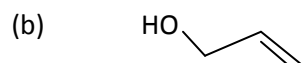
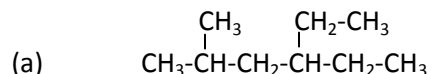
Ans: (i) Nitrogen & Chlorine

(ii) Refer the answer of Qn. No. 2

9. The purification technique used for the separation of chloroform and aniline is (1)

Ans: Distillation

10. Write the IUPAC names of the following: (2)



Ans: (a) 4-Ethyl-2-methylhexane

(b) Prop-2-en-1-ol

11. (a) What are nucleophiles? Give one example. (1)
(b) How will you detect the presence of nitrogen in an organic compound by Lassaigne's test? (2)
(c) Name any method for the estimation of nitrogen in an organic compound. (1) [December 2020]

Ans: (a) A reagent that brings an electron pair is called a nucleophile. Or, they are electron rich species attack at electron deficient centre. E.g.: OH^- , CN^- , NO_2^- , Cl^- , Br^- , I^- , H_2O , NH_3 , R-NH_2 etc.

(b) To a little of the sodium fusion extract, add freshly prepared ferrous sulphate (FeSO_4) solution, heated to boiling, cooled and acidified with dil. H_2SO_4 . If Nitrogen is present, a blue or green coloration or precipitate is formed.

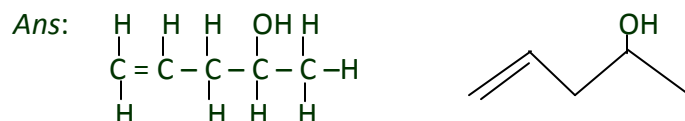
(c) Dumas method or Kjeldahl's method.

12. Liquids having large difference in boiling points are separated by

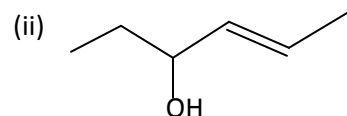
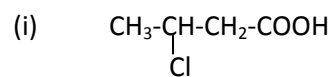
- (a) Distillation (b) Fractional distillation (c) Steam distillation (d) Vacuum distillation (1)

Ans: Distillation

13. Give the complete and bond line structure of pent-4-en-2-ol. (2)



14. (a) Write the IUPAC name of the following: (2)



(b) Write the functional isomers of molecule having molecular formula $\text{C}_3\text{H}_6\text{O}$. (1)

(c) How will you detect the presence of chlorine in an organic compound using Lassaigne's test? (1) [March 2020]

Ans: (a) (i) 3-Chlorobutanoic acid

(ii) Hex-4-en-3-ol

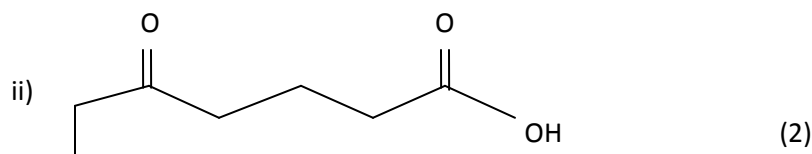
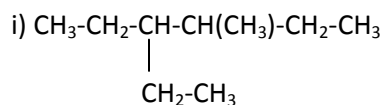
(b) $\text{CH}_3\text{-CO-CH}_3$ (Propanone) and $\text{CH}_3\text{-CH}_2\text{-CHO}$ (Propanal)

(c) Refer the answer of question no. 3 (b).

15. Name any one method used for the estimation of nitrogen present in an organic compound. (1)

Ans: Dumas method or Kjeldahl's method

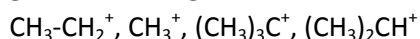
16. Write the IUPAC names of the following compounds :



Ans: i) 3-Ethyl-4-methylhexane

ii) 5-Oxoheptanoic acid

17. (a) Arrange the following carbocation in the increasing order of their stability.



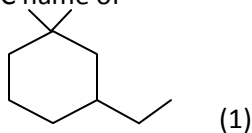
Justify your answer on the basis of hyper conjugation. (3)

(b) Define homolytic bond fission. (1) [July 2019]

Ans: (a) $\text{CH}_3^+ < \text{CH}_3\text{-CH}_2^+ < (\text{CH}_3)_2\text{CH}^+ < (\text{CH}_3)_3\text{C}^+$. As the number of hyper conjugative structures increases, the stability of the carbocation also increases. Here $(\text{CH}_3)_3\text{C}^+$ has 9, $(\text{CH}_3)_2\text{CH}^+$ has 6, $\text{CH}_3\text{-CH}_2^+$ has 3 and CH_3^+ has zero hyper conjugative structures.

(b) It is a type of bond fission in which each of the bonded atoms gets one of the shared pair of electrons.

18. Give the IUPAC name of



Ans: 3-Ethyl-1,1-dimethylcyclohexane

19. Differentiate homolytic cleavage from heterolytic cleavage of covalent bonds. (2)

Ans: Refer the answer of Qn. No. 2

20. Briefly explain the different types of structural isomerism shown by organic compounds with suitable examples. (4)

[March 2019]

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.

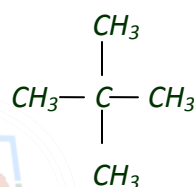
E.g.: Pentane (C_5H_{12})



n-pentane



isopentane
(2-Methylbutane)



neopentane
(2,2-Dimethylpropane)

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 $\text{C}_4\text{H}_{10}\text{O}$ may be 1-butanol or 2-butanol



1-Butanol



2-Butanol

b) 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 $\text{C}_2\text{H}_6\text{O}$ may be an alcohol ethanol ($\text{CH}_3\text{-CH}_2\text{OH}$) or an ether methoxymethane ($\text{CH}_3\text{-O-CH}_3$).

c) 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 $\text{C}_5\text{H}_{12}\text{O}$ may be methoxybutane ($\text{CH}_3\text{-O-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$) or ethoxypropane ($\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$).

21. What is metamerism? Write the metamers of $\text{C}_4\text{H}_{10}\text{O}$. (2)

Ans: Isomers which differ in the carbon chain (alkyl groups) around the functional group are called metamers and the phenomenon is called metamerism.

The metamers of $\text{C}_4\text{H}_{10}\text{O}$ are $\text{CH}_3\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$ and $\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$.

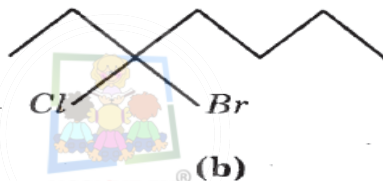
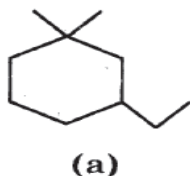
22. What is 'sodium fusion extract'? How the presence of N, S and halogens in organic compounds are detected? (4)

[August 2018]

Ans: Nitrogen, sulphur and halogens present in an organic compound are 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.

No.	Experiment	Observation	Inference
1.	To one part of sodium fusion extract add freshly prepared ferrous sulphate (FeSO_4) solution. Heated to boiling, cooled and acidified with dil. H_2SO_4 .	Blue or green coloration or precipitate (ppt)	Presence of nitrogen
2.	A little of the sodium fusion extract is acidified with dil. HNO_3 and then silver nitrate (AgNO_3) is added.	White ppt soluble in ammonium hydroxide (NH_4OH)	Presence of Chlorine
		Pale yellow ppt slightly soluble in NH_4OH	Presence of Bromine
		Yellow ppt insoluble in NH_4OH	Presence of Iodine
3.	To a little of the sodium fusion extract, add sodium nitroprusside solution	Violet colouration	Presence of sulphur

23. Give the IUPAC names of the following compounds.



(2)

Ans: (a) 3-Ethyl-1,1-dimethylcyclohexane
(b) 3-Bromo-3-chloroheptane

24. Briefly describe the principles of the following techniques, taking an example in each case.

- Crystallization
- Simple distillation
- Distillation under reduced pressure
- Paper chromatography (4 x 1 = 4) [March 2018]

Ans:

(a) Crystallisation: It is based on the difference in the solubilities of the compound and the impurities in a suitable solvent. The impure compound is dissolved in a solvent in which it is sparingly soluble at room temperature but appreciably soluble at higher temperature. The solution is concentrated to get a nearly saturated solution. On cooling the solution, pure compound crystallises out and is removed by filtration.

(b) Simple distillation: This method is used to separate (i) volatile liquids from non-volatile impurities and (ii) the liquids having sufficient difference in their boiling points. The principle of this method is that liquids having different boiling points vaporise at different temperatures. The vapours are cooled and the liquids so formed are collected separately.

(c) Distillation under reduced pressure: This method is used to purify liquids having very high boiling points and those, which decompose at or below their boiling points. Such liquids are made to boil at a temperature lower than their normal boiling points by reducing the pressure on their surface. The pressure is reduced with the help of a water pump or vacuum pump.

(d) Paper chromatography: It is a type of partition chromatography. Here a strip of chromatography paper, spotted at the base with the solution of the mixture, is suspended in a suitable solvent or a mixture of solvents. This solvent acts as the mobile phase. The solvent rises up the paper by capillary action and flows over the spot. The paper selectively retains different components according to their differing partition in the two phases.

25. a) A Method used to purify organic compound is chromatography. Explain adsorption chromatography. (2)
 b) Compounds having same molecular formula but different structures are called structural isomers. Explain any two structural isomerism. (2)
 c) Differentiate between nucleophiles and electrophiles. (2) [July 2017]

Ans: (a) Adsorption chromatography is based on the fact that different compounds are adsorbed on an adsorbent in different degrees. Commonly used adsorbents are silica gel and alumina. Here a mobile phase is allowed to move over a stationary phase (adsorbent). Based on the adsorbing power, the components of the mixture are adsorbed at different places over the stationary phase.

(b) Refer the Answer of the question no. 20

(c) A reagent that brings an electron pair is called a nucleophile. Or, nucleophiles are electron rich species attack at electron deficient centre. E.g. OH^- , CN^- , NO_2^- , Cl^- , Br^- , I^- , H_2O

A reagent that takes away an electron pair is called an electrophile. Or, electrophiles are electron deficient species attack at electron rich centre. E.g. carbocations (R^+), $-\text{CHO}$, $>\text{CO}$ etc.

26. a) Give the structural formula of the following compounds:®
 i) 2,4,7 – Trimethyloctane
 ii) 2-Chloro-4-methylpentane (2)
 b) CH_3CH_2^- or $(\text{CH}_3)_2\text{CH}^-$ which is more stable? Explain. (2)
 c) Explain the chemistry behind crystallisation. (2) [March 2017]

Ans: a) (i) $\text{CH}_3-\text{CH}(\text{CH}_3)-\text{CH}_2-\text{CH}(\text{CH}_3)-\text{CH}_2-\text{CH}_2-\text{CH}(\text{CH}_3)-\text{CH}_3$

(ii) $\text{CH}_3-\text{CH}(\text{Cl})-\text{CH}_2-\text{CH}(\text{CH}_3)-\text{CH}_3$

(b) CH_3CH_2^- is stabler. This is because the stability of carbanion follows the order $1^\circ > 2^\circ > 3^\circ$ due to inductive effect.

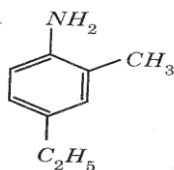
(c) Refer the Answer of the question no. 24

27. a) Give the IUPAC names of the following:

i)



ii)



(2)

- b) Which is more stable $(\text{CH}_3)_3\text{C}^+$ or CH_3CH_2^+ ? Give a reason. (2)

c) Give the chemistry behind distillation under reduced pressure.

(2) [March 2017]

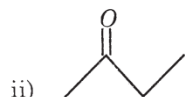
Ans: a) i) 3-Bromo-3-chloroheptane

ii) 4-Ethyl-2-methylaniline

b) $(\text{CH}_3)_3\text{C}^+$ is more stable. This is because the stability of carbocation follows the order $3^\circ > 2^\circ > 1^\circ$ due to inductive effect and hyper conjugation.

c) Refer the Answer of the question no. 24

28. a) Bond line notations of some organic compounds are given below. Write the condensed formula and IUPAC names.



(2)

b) Give the principle of estimation of nitrogen by Dumas method. (2)

c) Explain the concept of resonance with an example. (2) [September 2016]

Ans: a) (i) $\text{CH}_3\text{-CH}_2\text{-CH=CH}_2$ (But-1-ene)

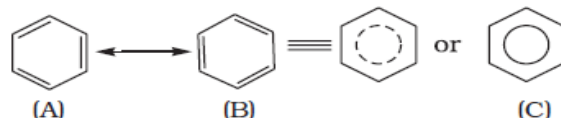
(ii) $\text{CH}_3\text{-CO-CH}_2\text{-CH}_3$ (Butan-2-one or Butanone)

b) Here the organic compound is heated with copper oxide in an atmosphere of carbon dioxide so that free nitrogen, carbon dioxide and water are produced.

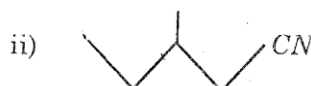
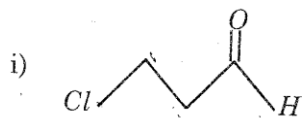


c) All the observed properties of some compounds cannot be explained by a single structure. Here more than one structures are used to explain the properties of the compound. These different structures are called resonance structures or canonical structures or contributing structures. The phenomenon is known as resonance.

Benzene (C_6H_6)



29. a) Give the IUPAC names of the following:



(2)

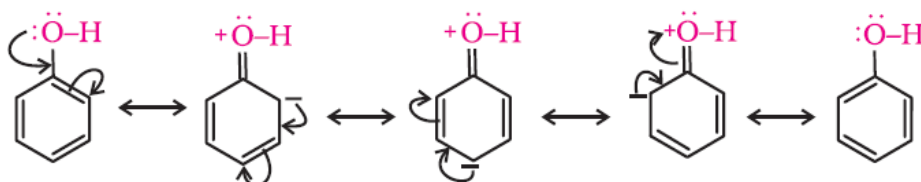
b) Phenol exhibit resonance.

i) Draw the resonance structures of phenol. (2)

ii) Predict the directive influence of $-\text{OH}$ group in benzene ring. (2)

Ans: a) i) 3-chloropropanal ii) 3-methylpentanenitrile

b) i) Resonance structures of phenol



ii) – OH group is an ortho-para directing group, since in the resonating structures, the electron density is greater in these positions.

30. a) Write the structural formula of the following compounds:

i) Pent-4-en-2-ol

ii) 6-Hydroxyheptanal (2)

b) Reagents which attack organic compounds may be classified as electrophiles, nucleophiles and free radicals.

i) Explain the nucleophiles and electrophiles with suitable examples. (3)

ii) Name the type of the fission of a covalent bond which gives free radicals. (1) [March 2016]

Ans: a) (i) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}(\text{OH}) - \text{CH}_3$

(ii) $\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CHO}$

b) i) A reagent that brings an electron pair is called a nucleophile. Or, nucleophiles are electron rich species attack at electron deficient centre.

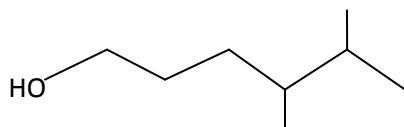
Example for nucleophiles are OH^- , CN^- , NO_2^- , Cl^- , Br^- , I^- , H_2O , NH_3 , R-NH_2 etc.

A reagent that takes away an electron pair is called an electrophile. Or, electrophiles are electron deficient species attack at electron rich centre.

Example for electrophiles are carbocations (R^+), $-\text{CHO}$, $>\text{CO}$ etc.

ii) Homolysis or homolytic fission

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



Write its condensed formula and give the IUPAC name. (2)

Ans: $\text{HO-CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}(\text{CH}_3) - \text{CH}(\text{CH}_3) - \text{CH}_3$

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

32. Explain the different types of electron displacement effects in covalent bonds.

(Hint: Inductive effect, resonance effect, electromeric effect, hyper conjugation). (4)

Ans: **Inductive effect:** It is a permanent effect arising due to the shifting of sigma electrons through a carbon chain in presence of an atom or group of atom (having different electronegativity) attached to a carbon chain. This effect propagates only through C – C σ bonds.

Electromeric effect: It is defined as the complete transfer of a shared pair of π -electrons to one of the atoms joined by a multiple bond in presence of an attacking reagent. It is a temporary effect. It is possible only in compounds containing multiple bonds.

Resonance effect: It is defined as the polarity produced in the molecule by the interaction of two π -bonds or between a π -bond and lone pair of electrons present on an adjacent atom.

Hyper conjugation: It is a permanent effect. In this effect the σ electrons of C—H bond of the alkyl group enter into partial conjugation with the unsaturated system or with the unshared p orbital. i.e. the σ electrons of C—H bonds get delocalised.

33. How is sodium fusion extract prepared? Using this, how will you detect the presence of Nitrogen, Sulphur and Halogen in an organic compound? (4) [October 2015]

Ans: Refer the Answer of the question no. 22

34. What do you mean by the following terms?

- a) Homolytic fission b) Heterolytic fission c) Nucleophiles d) electrophiles (4)

Ans: Refer the Answer of the question no. 19 and 25 (c).

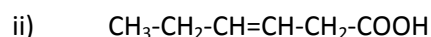
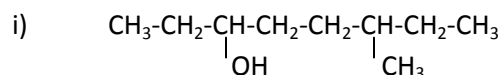
35. Various methods for the purification of organic compounds are based on the nature of the compound and the impurity present in it. Explain the principle involved in the following methods of purification:

- a) Distillation b) Steam distillation (4) [March 2015]

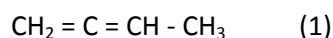
*Ans: a) **Distillation:** This method is used to separate (i) volatile liquids from non-volatile impurities and (ii) the liquids having sufficient difference in their boiling points. The principle of this method is that liquids having different boiling points vaporise at different temperatures. The vapours are cooled and the liquids so formed are collected separately.*

- b) **Steam distillation:** This technique is applied to separate substances which are steam volatile and are immiscible with water. In steam distillation, steam from a steam generator is passed through a heated flask containing the liquid to be distilled. The mixture of steam and the volatile organic compound is condensed and collected. The compound is later separated from water using a separating funnel.*

36. a) Give the IUPAC names of the following compounds: (2)



b) How many 'σ' and 'π' bonds are present in the following compounds?



c) Write the name of the test used to detect nitrogen, sulphur, halogens and phosphorous present in an organic compound. (1)

d) Explain any one method for the estimation of nitrogen present in an organic compound. (2) [August 2014]

Ans: a) i) 6-Methyloctan-3-ol

ii) Hex-3-en-1-oic acid

b) σ bonds - 9

π bonds – 2

c) Lassaigne's test

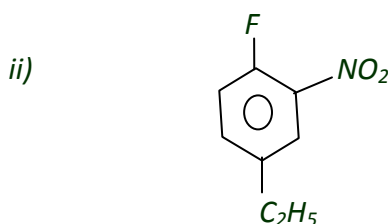
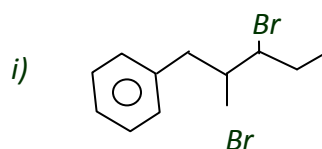
37. a) Draw the structures of the following compounds.

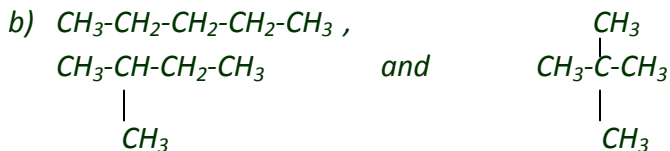
i) 2,3-Dibromo-1-phenylpentane

ii) 4-Ethyl-1-fluoro-2-nitrobenzene (3)

b) Write all the possible chain isomers of the compound with molecular formula C₅H₁₂. (3)

Ans: a)

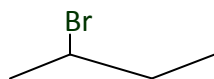
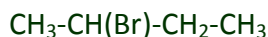
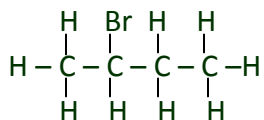




38. a) Write the complete, condensed and bond line structural formulae of 2-bromobutane. (3)

b) In the Carius method of estimation of halogen, 0.15g of an organic compound gave 0.12g of AgBr. Find the percentage of Br in the compound. (3) [March 2014]

Ans: a)



Complete structural formula Condensed structural formula Bond line formula

b) Mass of organic compound (m) = 0.15 g

Mass of AgBr formed (m_1) = 0.12 g

Atomic mass of Br = 80

Molar mass of AgBr = $108 + 80 = 188$ g/mol

$$\text{Percentage of Br} = \frac{\text{Atomic mass of Br} \times m_1 \times 100 \%}{\text{Molecular mass of AgBr} \times m} = \frac{80 \times 0.12 \times 100}{188 \times 0.15} = \underline{\underline{34.04 \%}}$$

39. i) Different methods are used to purify organic compounds. Name any three methods of purification. (3)

ii) On complete combustion, 0.246g of an organic compound gave 0.198g of CO_2 and 0.1014g of H_2O . Determine the percentage composition of carbon and hydrogen in the compound. (3)

Ans: i) Sublimation, Crystallisation, Distillation etc.

ii) Mass of organic compound (m) = 0.246 g

Mass of CO_2 formed (m_1) = 0.198 g

$$\text{Percentage of carbon} = \frac{12 \times m_1 \times 100}{44 \times m} = \frac{12 \times 0.198 \times 100}{44 \times 0.246} = 21.95\%$$

Mass of water formed (m_2) = 0.1014 g

$$\text{Percentage of hydrogen} = \frac{2 \times m_2 \times 100}{18 \times m} = \frac{2 \times 0.1014 \times 100}{18 \times 0.246} = 4.58\%$$

40. i) What is homologous series? (1)

ii) Hyper conjugation is a general stabilizing interaction. Write the hyper-conjugative structures of $\text{CH}_3\text{-CH}_2^+$ (ethyl cation) (2)

iii) Write the structures of the following organic compounds.

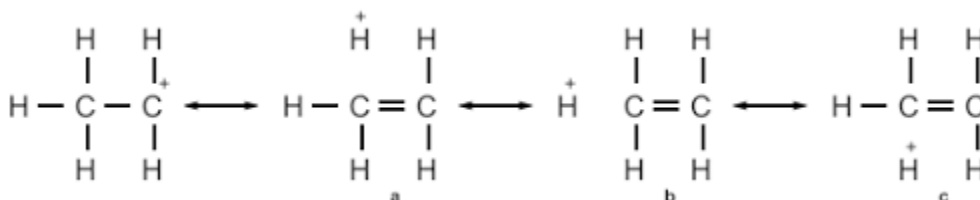
a) 2,5,6 – Trimethyloctane

b) Hexane-2,4-dione

c) 5-oxohexanoic acid (3) [September 2013]

Ans: i) A series of organic compounds in which adjacent members are differed by a $-\text{CH}_2$ group is called a homologous series.

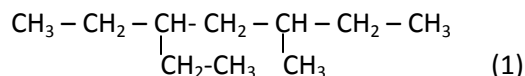
ii)



- iii) a) $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \text{CH}_3$
 b) $\text{CH}_3 - \text{CO} - \text{CH}_2 - \text{CO} - \text{CH}_2 - \text{CH}_3$
 c) $\text{CH}_3 - \text{CO} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{COOH}$

41. The IUPAC names of alkanes are based on their chain structure.

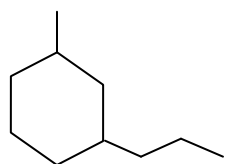
a) Give the IUPAC name of



- b) Represent 1-Methyl-3-propylcyclohexane using bond line notation. (1)
 c) What is the type of hybridization of C in CH_3^+ ? Also predict its shape. (1)
 d) Name the type of bond fission resulting in the formation of free radicals? (1)

Ans: a) 3-Ethyl-5-methylheptane

b)



c) sp^2 , Planar triangular shape.

d) Homolysis

42. Organic compounds have to be purified before analysis.

- a) Which type of liquids can be purified using distillation under reduced pressure? Suggest an example. (1)
 b) Name the two main types of chromatographic techniques based on the principle of differential adsorption. (1)
 c) In the Lassaigne's test for halogens, they are precipitated as (1)
 d) In what form is nitrogen estimated in the Dumas method? (1) [March 2013]

Ans: a) Liquids having very high boiling points and those, which decompose at or below their boiling points. E.g. Glycerol can be separated from spent-lye using this method.

b) Column chromatography and Thin layer chromatography.

c) Silver halide (AgX)

d) Dinitrogen (N_2)

43. Many chemical properties of organic compounds can be explained on the basis of electron displacement effects.

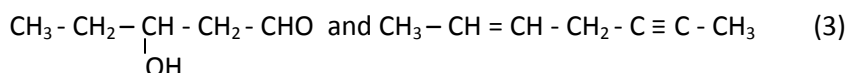
- a) What is resonance effect? (1)
 b) Categorize the following functional groups into those having +R effect and -R effect: (1)
 $-\text{NH}_2$, $-\text{NO}_2$, $-\text{COOH}$, $-\text{OH}$ (1) [March 2013]

Ans: a) It is defined as the polarity produced in the molecule by the interaction of two π -bonds or between a π -bond and lone pair of electrons present on an adjacent atom.

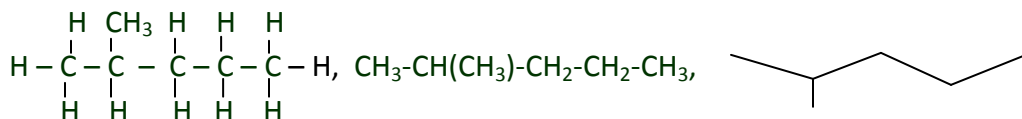
b) + R Effect groups: $-\text{NH}_2$, $-\text{OH}$

-R Effect groups: $-\text{NO}_2$, $-\text{COOH}$.

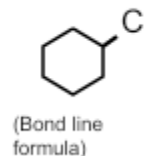
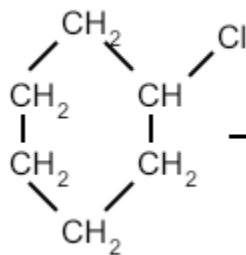
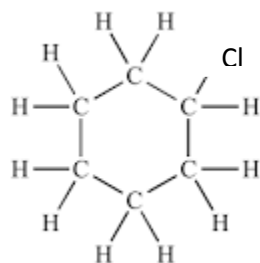
44. i) Give the complete, condensed and bond line formula of 2-methyl pentane and chlorocyclohexane. (3)
 ii) Write the IUPAC name of the following compounds:



Ans: i) 2-Methylpentane



Chlorocyclohexane



ii) 3-Hydroxypentanal and Hept-2-en-5-yne

45. i) Give any three types of structural isomers. Give examples. (3)
 ii) How will you identify the presence of Halogen by using sodium fusion extract? (2)
 iii) Name the method for estimation of Halogen. (1) [September 2012]

Ans: i) Refer the Answer of the question no. 20

ii) Refer the Answer of the question no. 22

iii) Carius method

46. A group of organic compounds, each containing a characteristic functional group forms a homologous series.

- a) Give an example for a homologous series. (1)
 b) Give the IUPAC name of the following compound: $\text{CH}_3\text{-CH}_2\text{-CO-CH}_2\text{-CH}_2\text{-COOH}$
 c) Write the metamers corresponding to the molecular formula $\text{C}_4\text{H}_{10}\text{O}$. (2)

Ans: (a) Alkane

(b) 4-oxohexanoic acid

(c) $\text{CH}_3\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$ and $\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$

47. Different techniques are used for the purification of organic compounds based on their nature.

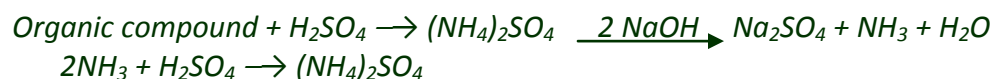
- a) Suggest a suitable method for the separation of a mixture of aniline and water. (1)
 b) Give the chemical name of the compound responsible for the blue colour in the Lassaigne's test for nitrogen. (1)
 c) Briefly explain the principle involved in Kjeldahl's method for the estimation of nitrogen. (2) [March 2012]

Ans: a) Steam distillation

b) Ferriferrocyanide or Iron (III) hexacyanoferrate (II) or Prussian blue.

c) Here the organic compound containing nitrogen is heated with concentrated sulphuric acid.

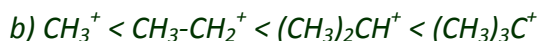
Nitrogen in the compound gets converted to ammonium sulphate. The resulting acid mixture is then heated with excess of sodium hydroxide. The liberated ammonia gas is absorbed in an excess of standard solution of sulphuric acid. The amount of ammonia produced is determined by estimating the amount of sulphuric acid consumed in the reaction. It is done by estimating unreacted sulphuric acid left after the absorption of ammonia by titrating it with standard alkali solution.



48. Carbocations are formed by the heterolytic cleavage of a covalent bond.

- a) What is heterolytic bond fission? (1)
 b) Arrange the following carbocations in the increasing order of stability:
 $(\text{CH}_3)_2\text{CH}^+$, CH_3^+ , $(\text{CH}_3)_3\text{C}^+$, $\text{CH}_3\text{-CH}_2^+$ (1) [March 2012]

Ans: a) In heterolytic bond fission, the bond breaks in such a manner that the shared pair of electrons remains with one of the parts.



49. A series of organic compounds containing a characteristic functional group and represented by a general formula is called a homologous series.

- a) Classify the following into homologous series and name the series.
 C_3H_8 , $\text{C}_2\text{H}_5\text{Cl}$, C_6H_{14} , $\text{C}_4\text{H}_9\text{Cl}$, $\text{C}_2\text{H}_5\text{OH}$, $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-Cl}$, $\text{CH}_3\text{-CHOH-CH}_3$ (3)
 b) Write the general formulae of the following homologous series.
 i) Alkynes ii) Alcohols iii) Chloroalkanes (3) [October 2011]

Ans: a) Alkanes - C_3H_8 , C_6H_{14}

Alkyl chlorides (Chloroalkanes) - $\text{C}_2\text{H}_5\text{Cl}$, $\text{C}_4\text{H}_9\text{Cl}$, $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-Cl}$

Alcohols - $\text{CH}_3\text{-CHOH-CH}_3$, $\text{C}_2\text{H}_5\text{OH}$

b) i) Alkynes - $\text{C}_n\text{H}_{2n-2}$ ii) Alcohols - $\text{C}_n\text{H}_{2n+1}\text{OH}$ iii) Chloroalkanes - $\text{C}_n\text{H}_{2n+1}\text{Cl}$

50. Hybridization influences the bond length and bond enthalpy in organic compounds:

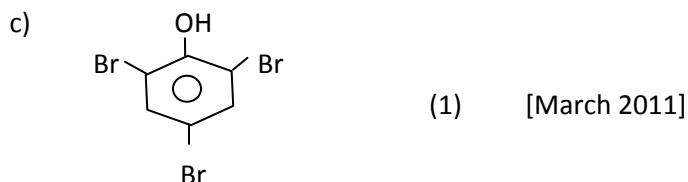
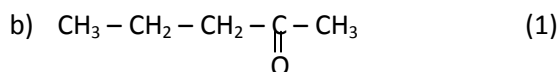
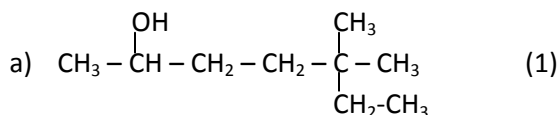
- a) Compare the bond length and bond strength of C-H bonds formed by sp and sp^3 hybridized carbon atoms.
 Give reason (2)
 b) How many 'σ' and 'π' bonds are present in the following compounds?
 i) $\text{CH}_3\text{-CH}_2\text{-CH}_3$
 ii) $\text{CH}_3\text{-C}\equiv\text{CH}$ (1)

Ans: a) sp hybridized carbon has 50% s-character, while sp^3 hybridized carbon has only 25% s-character. Greater the s-character, greater will be the electronegativity. So the C – H bond attached to sp hybridized carbon has the shortest bond length. Since the electron pairs are more shifted to Carbon atom, that C-H bond can easily dissociated.

b) i) $\text{CH}_3\text{-CH}_2\text{-CH}_3$ No. of σ bonds – 10, No of π bonds – 0

ii) $\text{CH}_3\text{-C}\equiv\text{CH}$ No. of σ bonds – 6, No of π bonds – 2

51. Give the IUPAC names of the following:




Ans: a) 5,5-Dimethylheptan-2-ol

b) *Pentan-2-one*c) *2,4,6-Tribromophenol*

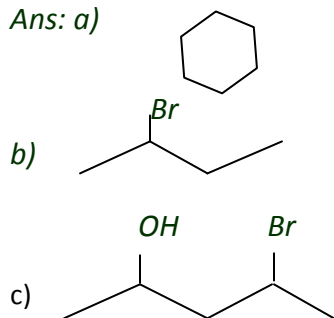
52. Detection of elements like nitrogen, halogens and sulphur are done by using Lassaigne's test. Discuss the chemistry of Lassaigne's test for the above elements. (6) [September 2010]

Ans: Refer the Answer of the question no. 8

53. The bond line representation of cyclopropane is . Write the bond line structures of

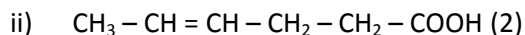
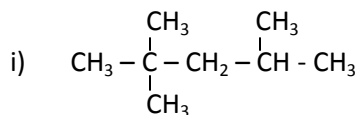
- a) Cyclohexane
b) 2-Bromobutane
c) $\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_2 - \text{CHBr} - \text{CH}_3$ (3)

Ans: a)

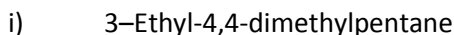


54. The IUPAC name of an organic compound is derived by identifying the functional group and the parent hydrocarbon chain.

- a) Write the IUPAC name of the following:

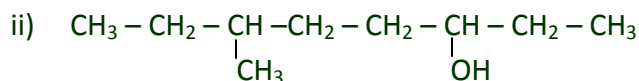
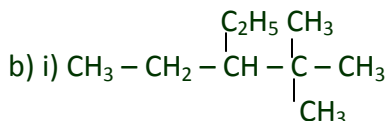


- b) Give the structures of the following compounds:

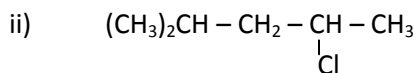
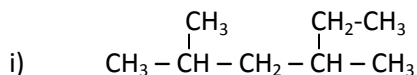


Ans: a) i) 2,2,4-Trimethylpentane

ii) Hex-4-en-1-oic acid (Hex-4-enoic acid)



55. a) Write the IUPAC name of the following compounds :



(3)

b) Draw the structure of the molecules represented by the IUPAC names – pent-4-en-2-ol and nitrocyclohexane.

(2)

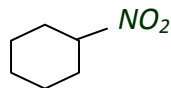
[March 2009]

Ans: a) i) 2,4-Dimethylhexane

ii) 2-Chloro-4-methylpentane

iii) Cyclohex-2-en-1-ol

b) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}(\text{OH}) - \text{CH}_3$ and



56. You are given a compound containing nitrogen. Explain how you will proceed to determine the Nitrogen content.

(4) [June 2008]

Ans: Refer the Answer of the question no. 22

57. C_2H_6 and C_5H_{12} are members of a homologous series.

a) What is a homologous series? (1)

b) What is the general molecular formula of the above homologous series? (1)

c) What is the significance of $-\text{CH}_2-$ group in homologous series? (1) [February 2008]

Ans: a) Refer the Answer of the question no. 40 (a)

b) $\text{C}_n\text{H}_{2n+2}$

c) In homologous series, if add $-\text{CH}_2-$ group to a member, we get the next member.

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