Previous Years Problems on Organic Chemistry: Some Basic Principles and Techniques for NEET

This Chapter "Previous Years Problems on Organic Chemistry: Some Basic Principles and Techniques for NEET" is taken from our Book:

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Product Name : 30 Years NEET Chapter-wise & Topic-wise Solved Papers Chemistry (2017 - 1988)

Product Description : • NEET Topic-wise Solved Papers Chemistry contains the past year papers of NEET, 1988 to 2017 distributed in 31 Topics.

• The Topics have been arranged exactly in accordance to the NCERT books so as to make it 100 percent convenient to Class 11 and 12 students.

• The fully solved CBSE Mains papers of 2011 and 2012 (the only Objective CBSE Mains paper held) have also been incorporated in the book topic-wise.

• The book also contains NEET 2013 along with the Karnataka NEET 2013 paper.

• The detailed solutions of all questions are provided at the end of each chapter to bring conceptual clarity.

• The book contains around 1600+ milestone problems in Physics.
Chapter 12

Organic Chemistry - Some Basic Principles and Techniques

Topic 1: Classification and Nomenclature of Organic Compounds

1. The IUPAC name of the compound is: [2017]

   ![Chemical Structure]

   (a) 5-formylhex-2-en-3-one
   (b) 5-methyl-4-oxohex-2-en-5-al
   (c) 3-keto-2-methylhex-5-enal
   (d) 3-keto-2-methylhex-4-enal

2. Structure of the compound whose IUPAC name is 3-ethyl-2-hydroxy-4-methylhex-3-en-5-ynoic acid is: [NEET 2013]

   ![Chemical Structure]

   (a) OH
   (b) OH
   (c) COOH
   (d) COOH

3. The structure of isobutyl group in an organic compound is: [NEET 2013]

   ![Chemical Structure]

4. Which nomenclature is not according to IUPAC system? [2012]

   (a) \( \text{Br} - \text{CH}_2 - \text{CH} = \text{CH}_2 \),
   1-Bromo-prop-2-ene

   ![Chemical Structure]

   (b) \( \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \),
   4-Bromo-2,4-dimethylhexane

   ![Chemical Structure]

   (c) \( \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \),
   2-Methyl-3-phenylpentane

   ![Chemical Structure]

   (d) \( \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 \text{COOH} \)
   5-oxohexanoic acid

5. The correct IUPAC name of the compound [2011]

   ![Chemical Structure] is
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(a) 4-Ethyl-3-propyl hex-1-ene
(b) 3-Ethyl-4-ethenyl heptane
(c) 3-Ethyl-4-propyl hex-1-ene
(d) 3-(1-ethylpropyl) hex-1-ene

6. The IUPAC name of the following compound is [2011 M]

\[
\begin{align*}
\text{Cl} & \quad \text{CH}_2\text{CH}_3 \\
\text{CH}_3 & \quad \text{I}
\end{align*}
\]

(a) trans-2-chloro-3-iodo-2-pentene
(b) cis-3-iodo-4-chloro-3-pentene
(c) trans-3-iodo-4-chloro-3-pentene
(d) cis-2-chloro-3-iodo-2-pentene

7. The state of hybridization of C₂, C₃, C₅ and C₆ of the hydrocarbon, [2009]

\[
\begin{align*}
\text{CH}_3 & \quad \text{C} \quad \text{CH} = \text{CH} \quad \text{C} \equiv \text{CH} \\
\text{CH}_3 & \quad \text{CH}_3
\end{align*}
\]

is in the following sequence:
(a) sp³, sp², sp² and sp
(b) sp, sp², sp² and sp³
(c) sp, sp², sp³ and sp²
(d) sp, sp³, sp² and sp³

8. In the hydrocarbon

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH} = \text{CH} \quad \text{CH} \quad \text{C} \equiv \text{CH} \\
\text{CH}_3 & \quad \text{CH}_3
\end{align*}
\]

The state of hybridization of carbons 1, 3 and 5 are in the following sequence: [2008]
(a) sp², sp, sp³ (b) sp, sp³, sp² (c) sp, sp², sp³ (d) sp³, sp², sp

9. The general molecular formula, which represents the homologous series of alkanols is [2006]

(a) \( C_n\text{H}_{2n}O \) (b) \( C_n\text{H}_{2n+1}O \)
(c) \( C_n\text{H}_{2n+2}O \) (d) \( C_n\text{H}_{2n+1}O_2 \)

10. The IUPAC name of [2006]

\[
\begin{align*}
\text{O} & \quad \text{Cl}
\end{align*}
\]

(a) 1-chloro-1-oxo-2, 3-dimethyl penta
e
(b) 2-ethyl-3-methylbutanoyl chloride
(c) 2, 3-dimethylpentanoyl chloride
(d) 3, 4-dimethyl pentanoyl chloride

11. The correct order regarding the electronegativity of hybrid orbitals of carbon is [2006]
(a) sp > sp² > sp³ (b) sp < sp² > sp³
(c) sp < sp² < sp³ (d) sp > sp² < sp³

12. Names of some compounds are given. Which one is not correct in IUPAC system? [2005]

\[
\begin{align*}
\text{CH}_3 \quad \text{CH}_2 \quad \text{CH}_2 \quad \text{CH} \quad \text{CH} - \text{CH}_2\text{CH}_3 \\
\text{CH}_2\text{CH}_3
\end{align*}
\]

(a) CH₃ – CH₂ – CH₂ – CH – CH₂CH₃
(b) CH₃ – CH – CH – CH₃
(c) CH₃ – CH₂ – C – CH – CH₃
(d) CH₃ – C ≡ C – CH – (CH₂)₂

13. Name of the compound given below is [2003]

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH} \\
\text{CH}_3 & \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_3
\end{align*}
\]

(a) 5-ethyl-6-methyloctane
(b) 4-ethyl-3-methyloctane
(c) 3-methyl-4-ethyl octane
(d) 2, 3-diethylheptane

14. IUPAC name of the following is [2002]

\[
\begin{align*}
\text{CH}_2 & \quad \text{CH} \quad \text{CH}_2 \quad \text{CH}_2 \quad \text{C} ≡ \text{CH} \\
\text{CH}_3 & \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_3
\end{align*}
\]

(a) 1, 5-hexenyne (b) 1-hexene-5-yne
(c) 1-hexyne-5-ene (d) 1, 5-hexynene

15. The incorrect IUPAC name is [2001]

\[
\begin{align*}
\text{CH}_3 & \quad \text{C} \quad \text{H} \quad \text{H} \quad \text{CH} \\
\text{O} & \quad \text{CH}_3
\end{align*}
\]

(a) CH₃ – C – CH – CH₃
(b) CH₃ – CH – CH – CH₃
(c) CH₃ – CH₂ – C – CH – CH₃
(d) CH₃ – C ≡ C – CH – (CH₂)₂

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_2\text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_2\text{CH}_3
\end{align*}
\]

(a) 2-Methyl-3-butanone
(b) 2,3-Dimethylpentane
(c) 2-Bromo-3-chlorobutane
(d) 4-Methyl-2-pentyne
16. The structural formula of a compound is \( \text{CH}_3 - \text{CH} = \text{C} = \text{CH}_2 \). The types of hybridization at the four carbons from left to right are
(a) \( \text{sp}^2 \), \( \text{sp}^2 \), \( \text{sp}^2 \), \( \text{sp}^3 \)
(b) \( \text{sp}^2 \), \( \text{sp}^3 \), \( \text{sp}^2 \), \( \text{sp}^2 \)
(c) \( \text{sp}^3 \), \( \text{sp}^3 \), \( \text{sp} \), \( \text{sp}^2 \)
(d) \( \text{sp}^3 \), \( \text{sp}^3 \), \( \text{sp}^2 \), \( \text{sp}^2 \)

17. IUPAC name for the compound \([1998]\)
\[
\text{Cl} \quad \text{C} = \text{C} \quad \text{CH}_2\text{CH}_3
\]
is
(a) trans-3-iodo-4-chloro-3-pentene
(b) cis-2-chloro-3-iodo-2-pentene
(c) trans-2-chloro-3-iodo-2-pentene
(d) cis-3-iodo-4-chloro-3-pentene

18. The IUPAC name of \([1996]\)
\[
\text{H}_3\text{C} - \text{CH} - \text{CH} - \text{CH}_2\text{CH}_2 - \text{CH} - \text{CH}_3
\]
is
(a) 1, 3-isopropyl-3-methylpropane
(b) 2, 3, 6-trimethylheptane
(c) 2, 5, 6-trimethylheptane
(d) 2, 6, 3-trimethylheptane

19. Huckel’s rule states that a monocyclic conjugated compound will be aromatic if it contains
(a) \( (4n + 2 \pi) \) electrons
(b) \( (4\pi + 2n) \) electrons
(c) \( 4\pi \) electrons
(d) \( (4n + 2)\pi \) electrons

20. The first organic compound, synthesized in the laboratory, was \([1995]\)
(a) alcohol
(b) acetic acid
(c) urea
(d) none of these

21. Which of the following IUPAC names is correct for the compound? \([1994]\)
\[
\text{H}_3\text{C} - \text{CH} - \text{CH} - \text{CH}_2\text{CH}_3
\]
(a) 2-Methyl-3-ethylpentane
(b) 3-Ethyl-2-methylpentane
(c) 2-Ethyl-3-methylpentane
(d) 3-Methyl-2-ethylpentane

22. Which is the correct symbol relating the two Kekule structures of benzene? \([1993]\)
(a) \( \equiv \)
(b) \( \equiv \)
(c) \( \equiv \)
(d) \( \equiv \)

23. When the hybridization state of carbon atom changes from \( \text{sp}^3 \) to \( \text{sp}^2 \) and finally to \( \text{sp} \), the angle between the hybridized orbitals \([1993]\)
(a) decreases gradually
(b) decreases considerably
(c) is not affected
(d) increases progressively.

24. The IUPAC name of \([1992]\)
\[
\text{CH}_3 - \text{CH} - \text{CH} = \text{C} - \text{CHO}
\]
(a) 4-Hydroxy-1-methylpentanal
(b) 4-Hydroxy-2-methylpent-2-en-1-al
(c) 2-Hydroxy-4-methylpent-3-en-5-al
(d) 2-Hydroxy-3-methylpent-2-en-5-al

25. 2-Methyl-2-butene will be represented as \([1992]\)
\[
\text{CH}_3
\]
(a) \( \text{CH}_3 - \text{CH} - \text{CH}_2\text{CH}_3
\]
(b) \( \text{CH}_3 - \text{C} = \text{CH} - \text{CH}_3
\]
(c) \( \text{CH}_3 - \text{CH}_2 - \text{C} = \text{CH}_2
\]
(d) \( \text{CH}_3 - \text{CH} - \text{CH}_2 = \text{CH}_2
\]

26. A straight chain hydrocarbon has the molecular formula \( \text{C}_8\text{H}_{10} \). The hybridization of the carbon atoms from one end of the chain to the other are respectively \( \text{sp}^3 \), \( \text{sp}^3 \), \( \text{sp}^2 \), \( \text{sp}^2 \), \( \text{sp}^3 \), \( \text{sp}^2 \), \( \text{sp} \) and \( \text{sp} \). The structural formula of the hydrocarbon would be: \([1991]\)
(a) \( \text{CH}_3\text{C} \equiv \text{CH}_2 - \text{CH} = \text{C} = \text{CH} = \text{CH}_2
\]
(b) \( \text{CH}_3\text{CH} = \text{CH} = \text{CH} = \text{CH} = \text{CH} = \text{CH}_2
\]
(c) \( \text{CH}_3\text{CH} = \text{C} = \text{CH} = \text{CH} = \text{CH} = \text{CH}_2
\]
(d) \( \text{CH}_3\text{CH} = \text{CH} \equiv \text{CH} = \text{CH} = \text{CH} = \text{CH}_2
\]

27. An \( \text{sp}^3 \) hybrid orbital contains \([1991]\)
(a) \( 1/4 \) s-character
(b) \( 1/2 \) s-character
(c) \( 1/3 \) s-character
(d) \( 2/3 \) s-character.

28. The shortest C – C bond distance is found in \([1991]\)
(a) Diamond
(b) Ethane
(c) Benzene
(d) Acetylene

29. An organic compound \( \text{X} \) (molecular formula \( \text{C}_8\text{H}_{12}\text{O}_2\text{N} \)) has six carbon atoms in a ring system, two double bonds and a nitro group as substituent, \( \text{X} \) is \([1990]\)
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(a) Homocyclic but not aromatic
(b) Aromatic but not homocyclic
(c) Homocyclic and aromatic
(d) Heterocyclic and aromatic

30. Which of the following possesses a sp-carbon in its structure?

(a) CH₂ = CCl – CH = CH₂
(b) CCl₂ = CCl₂
(c) CH₂ = C = CH₂
(d) CH₂ = CH – CH = CH₂

31. Cyclic hydrocarbon ‘A’ has all the carbon and hydrogen atoms in a single plane. All the carbon carbon bonds have the same length, less than 1.54 Å, but more than 1.34 Å. The C – C – C bond angle will be

(a) 109°28’ (b) 100° (c) 180° (d) 120°

32. The Cl – C – Cl angle in 1,1,2,2-tetrachloroethene and tetrachloromethane respectively will be about

(a) 120° (b) 90° and 109.5° (c) 109.5° and 90° (d) 120° and 109.5°

Topic 2: Isomerism in Organic Compounds

33. Which of the following biphenyls is optically active?

(a) \( \text{O}_2\text{N} \)
(b) \( \text{BrBr} \)
(c) \( \text{CH}_3 \)
(d) \( \text{CH}_3 \)

34. The correct statement regarding the comparison of staggered and eclipsed conformation of ethane, is

(a) The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain
(b) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain
(c) The eclipsed conformation of ethane is more stable than staggered conformation even though the eclipsed conformation has torsional strain
(d) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

35. Two possible stereo-structures of CH₃CHOH.COOH, which are optically active, are called.

(a) Diastereomers (b) Atropisomers (c) Enantiomers (d) Mesomers

36. Given

Which of the given compounds can exhibit tautomerism?

(a) I and III (b) II and III (c) I, II and III (d) I and II

37. Given

I and II are

(a) A pair of optical isomers (b) Identical (c) A pair of conformers (d) A pair of geometrical isomers

38. Which of the following acids does not exhibit optical isomerism?
39. In the following the most stable conformation of \( n \)-butane is:

(a) 
\[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]

(b) 
\[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]

(c) 
\[
\begin{array}{c}
\text{CH}_3 \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{CH}_3
\end{array}
\]

(d) 
\[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{CH}_3 \\
\text{H} \\
\text{CH}_3 \\
\text{H}
\end{array}
\]

40. Which of the following conformers for ethylene glycol is most stable?

(a) 
\[
\begin{array}{c}
\text{OH} \\
\text{H} \\
\text{H}
\end{array}
\]

(b) 
\[
\begin{array}{c}
\text{OH} \\
\text{H} \\
\text{H}
\end{array}
\]

(c) 
\[
\begin{array}{c}
\text{OH} \\
\text{H} \\
\text{H}
\end{array}
\]

(d) 
\[
\begin{array}{c}
\text{OH} \\
\text{H} \\
\text{H}
\end{array}
\]

41. Which of the following compounds will exhibit cis-trans (geometrical) isomerism?

(a) Butanol  (b) 2-Butyne

(c) 2-Butenol  (d) 2-Butene

42. How many stereoisomers does this molecule have?

\[
\text{CH}_3\text{CH} = \text{CHCH}_2\text{CHBrCH}_3
\]

(a) 4   (b) 6

(c) 8   (d) 2

43. If there is no rotation of plane polarised light by a compound in a specific solvent, though to be chiral, it may mean that

(a) the compound is certainly meso

(b) there is no compound in the solvent

(c) the compound may be a racemic mixture

(d) the compound is certainly achiral.

44. \( \text{CH}_3 \text{C} - \text{CHCl} - \text{CH} - \text{CH}_3 \) has a chiral centre. Which one of the following represents its R-configuration?

(a) 
\[
\begin{array}{c}
\text{CH}_3 \\
\text{H} \\
\text{Cl} \\
\text{H}_{2}\text{C} - \text{C} - \text{Cl}
\end{array}
\]

(b) 
\[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{H} \\
\text{CH}_3
\end{array}
\]

(c) 
\[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{H} \\
\text{C}_2\text{H}_5
\end{array}
\]

(d) 
\[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{H} \\
\text{C}_2\text{H}_5
\end{array}
\]

45. Which of the following is not chiral?

(a) 2, 3- Dibromopentane

(b) 3-Bromopentane

(c) 2-Hydroxypropanoic acid

(d) 2-Butanol

46. The chirality of the compound

\[
\begin{array}{c}
\text{C}_2\text{H}_5 \\
\text{Cl} \\
\text{H}
\end{array}
\]

(a) R   (b) S

(c) E   (d) Z

47. Which one of the following pairs represents stereoisomerism?

(a) Structural isomerism and Geometrical isomerism

(b) Optical isomerism and Geometrical isomerism

(c) Chain isomerism and Rotational isomerism.

(d) Linkage isomerism and Geometrical isomerism
48. Number of chiral carbons in \( \beta-D-\text{(-)}+\) glucose is \[2004\]
(a) five \quad (b) six
(c) three \quad (d) four

49. The molecular formula of diphenylmethane, \( \text{C}_1\text{H}_2 \), is \( \text{C}_{13}\text{H}_{12} \).
How many structural isomers are possible when one of the hydrogens is replaced by a chlorine atom?
\[2004\]
(a) 6 \quad (b) 4
(c) 8 \quad (d) 7

50. Which of the following pairs of compounds are enantiomers?
\[2003\]
(a) \( \text{CH}_3 \text{CH}_3 \text{H} \text{OH} \) and \( \text{CH}_3 \text{CH}_3 \text{H} \text{OH} \)
(b) \( \text{HHOO} \text{CH}_3 \) and \( \text{HHOO} \text{CH}_3 \)
(c) \( \text{HHOO} \text{CH}_3 \) and \( \text{HHOO} \text{CH}_3 \)
(d) \( \text{HHOO} \text{CH}_3 \) and \( \text{HHOO} \text{CH}_3 \)

51. \( \text{C}_2\text{H}_2 \text{C} \text{C} \text{CH}_3 \) and \( \text{C}_2\text{H}_2 \text{C} \text{C} \) are \[2002\]
(a) Resonating structures
(b) Tautomers
(c) Geometrical isomers
(d) Optical isomers

52. Geometrical isomers differ in \[2002\]
(a) position of functional group
(b) position of atoms
(c) spatial arrangement of atoms
(d) length of carbon chain

53. A compound of molecular formula of \( \text{C}_7\text{H}_{16} \) shows optical isomerism, compound will be \[2001\]
(a) 2, 3-Dimethylpentane
(b) 2,2-Dimethylbutane
(c) 3-Methylhexane
(d) None of the above

54. Correct order of stability is : \[2000\]
(a) cis-2- butene > 1-butene > trans-2-butene
(b) trans-2-butene > cis-2-butene > 1-butene
(c) 1-butene > cis-2-butene > trans-2-butene
(d) cis-2-butene > trans-2-butene > 1-butene

55. The correct structure of trans-2 hexenal is \[1999\]
(a) \( \text{CHO} \)
(b) \( \text{CHO} \)
(c) \( \text{CHO} \)
(d) \( \text{CHO} \)

56. Which is a chiral molecule?
\[1999\]
(a) 2, 2-dimethylbutanoic acid
(b) 4-methylpentanoic acid
(c) 3-methylpentanoic acid
(d) 3,3-dimethylbutanoic acid

57. Which of the following compounds is not chiral?
\[1998\]
(a) \( \text{DCH}_2\text{CH}_2\text{CH}_2\text{Cl} \) (b) \( \text{CH}_3\text{CH}_2\text{CHDCl} \)
(c) \( \text{CH}_3\text{CHDCH}_2\text{Cl} \) (d) \( \text{CH}_3\text{CHClCH}_2\text{D} \)

58. Tautomerism will be exhibited by \[1997\]
(a) \( \text{(CH}_3\text{)}_2\text{NH} \) (b) \( \text{(CH}_3\text{)}_3\text{CNO} \)
(c) \( \text{R}_3\text{CNO} \) (d) \( \text{RCH}_2\text{NO}_2 \)

59. The most stable conformation of \( \text{n-butane} \) is \[1997\]
(a) skew boat \quad (b) gauche
(c) staggered-anti \quad (d) eclipsed

60. Which of the following will not show cis-trans isomerism? \[1996\]
(a) \( \text{CH}_3 \text{CH} = \text{CH} \text{CH}_3 \)
(b) \( \text{CH}_3 \text{CH} = \text{CH} \text{CH}_2 \text{CH}_3 \)
(c) \( \text{CH}_3 \text{CH} = \text{CH} \text{CH}_2 \text{CH}_3 \)
(d) \( \text{CH}_3 \text{CH} = \text{CH} \text{CH}_2 \text{CH}_3 \)
61. Which of the following will exhibit chirality?  [1996]
   (a) 2-Methylhexane  (b) 3-Methylhexane
   (c) Neopentane  (d) Isopentane

62. The number of possible isomers of the compound with molecular formula \( C_7H_8O \) is  [1995]
   (a) 3  (b) 5  (c) 7  (d) 9

63. An important chemical method to resolve a racemic mixture makes use of the formation of  [1994]
   (a) a meso compound  (b) enantiomers
   (c) diastereomers  (d) racemates

64. The process of separation of a racemic modification into \( \alpha \)- and \( \beta \)-enantiomers is called  [1994]
   (a) Resolution  (b) Dehydration
   (c) Revolution  (d) Dehydrohalogenation

65. The restricted rotation about carbon-carbon double bond in 2-butene is due to  [1993]
   (a) Overlap of one s- and sp\(^2\) - hybridized orbitals
   (b) Overlap of two sp\(^2\) - hybridized orbitals
   (c) Overlap of one p- and one sp\(^2\) - hybridized orbitals
   (d) Sideways overlap of two p- orbitals.

66. Isomers of a substance must have the same  [1991]
   (a) Structural formula  (b) Physical properties
   (c) Chemical properties  (d) Molecular formula

67. Which one of the following can exhibit cis-trans isomerism?  [1989]
   (a) \( CH_3 - CHCl - COOH \)
   (b) \( H - C - C - Cl \)
   (c) \( ClCH = CHCl \)
   (d) \( ClCH_2 - CH_2Cl \)

68. How many chain isomers could be obtained from the alkane \( C_6H_{14} \)?  [1988]
   (a) Four  (b) Five
   (c) Six  (d) Seven

69. Which of the following is an optically active compound?  [1988]
   (a) 1-Butanol  (b) 1-Propanol
   (c) 2-Chlorobutane  (d) 4-Hydroxyheptane

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**Topic 3: Concept of Reaction Mechanism in Organic Compounds**

70. The most suitable method of separation of a 1:1 mixture of ortho and para-nitrophenols is:  [2017]
   (a) Chromatography  (b) Crystallisation
   (c) Steam distillation  (d) Sublimation

71. The correct statement regarding electrophile is:-  [2017]
   (a) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from another electrophile
   (b) Electrophiles are generally neutral species and can form a bond by accepting a pair of electrons from a nucleophile
   (c) Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile
   (d) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from a nucleophile

72. The pair of electrons in the given carbanion, \( CH_3C \equiv C^- \), is present in which of the following orbitals?  [2016]
   (a) 2p  (b) sp\(^3\)
   (c) sp\(^2\)  (d) sp

73. Which of the following statements is not correct for a nucleophile?  [2015 RS]
   (a) Nucleophile is a Lewis acid
   (b) Ammonia is a nucleophile
   (c) Nucleophiles attack on less e\(^-\) density sites
   (d) Nucleophiles are not electron seeking.

74. Consider the following compounds  [2015]

```
I
CH \( _3 \) C \( \equiv \) CH

II
Ph

III
CH \( _3 \) C \( \equiv \) Ph
```

Hyperconjugation occurs in:
   (a) II only  (b) III only
   (c) I and III  (d) I only
75. Which of the following is the most correct electron displacement for a nucleophilic reaction to take place? [2015]

(a) $\text{H}_3\text{C} \overset{\text{C}}{\text{C}} \overset{\text{C}^-}{\text{C}} \overset{\text{Cl}}{\text{H}}$

(b) $\text{H}_3\text{C} \overset{\text{C}}{\text{C}} \overset{\text{C}^-}{\text{C}} \overset{\text{H}}{\text{H}}$

(c) $\text{H}_3\text{C} \overset{\text{C}}{\text{C}} \overset{\text{C}^-}{\text{C}} \overset{\text{Cl}}{\text{H}}$

(d) $\text{H}_3\text{C} \overset{\text{C}}{\text{C}} \overset{\text{C}^-}{\text{C}} \overset{\text{H}}{\text{H}}$

76. In Duma's method for estimation of nitrogen, 0.25 g of an organic compound gave 40 mL of nitrogen collected at 300 K temperature and 725 mm pressure. If the aqueous tension at 300 K is 25 mm, the percentage of nitrogen in the compound is:

(a) 18.20 (b) 16.76 (c) 15.76 (d) 17.36

77. Which of the following compounds will undergo racemisation when solution of KOH hydrolys? [2014]

(i) \[\text{\includegraphics{C6H5Cl}}\]

(ii) CH$_3$CH$_2$CH$_2$Cl

(iii) H$_3$C - CH - CH$_2$Cl

(iv) \[\text{\includegraphics{C6H5Cl}}\]

(a) (i) and (ii) (b) (ii) and (iv) (c) (iii) and (iv) (d) (i) and (iv)

78. In the Kjeldahl's method for estimation of nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralized 10 mL of 1 M H$_2$SO$_4$. The percentage of nitrogen in the soil is:

(a) 37.33 (b) 45.33 (c) 35.33 (d) 43.33

79. Some meta-directing substituents in aromatic substitution are given. Which one is most deactivating? [NEET 2013]

(a) $\text{SO}_3\text{H}$ (b) $\text{COOH}$ (c) $\text{NO}_2$ (d) $\text{C} \equiv \text{N}$

80. Which of the following compounds will not undergo Friedal-Craft's reaction easily?: [NEET 2013]

(a) Xylene (b) Nitrobenzene (c) Toluene (d) Cumene

81. Arrange the following in increasing order of stability [NEET Kar. 2013]

(A) \[\text{CH}_3 \overset{\text{C}}{\text{C}} \overset{\text{H}}{\text{H}} \overset{\text{H}}{\text{H}} \]

(B) \[\text{CH}_3 \overset{\text{C}}{\text{C}} \overset{\text{H}}{\text{H}} \overset{\text{H}}{\text{H}} \]

(C) \[\text{CH}_3 \overset{\text{C}}{\text{C}} \overset{\text{H}}{\text{H}} \overset{\text{H}}{\text{H}} \]

(D) \[\text{CH}_3 \overset{\text{C}}{\text{C}} \overset{\text{H}}{\text{H}} \overset{\text{H}}{\text{H}} \]

(a) E < D < C < B < A (b) E < D < C < A < B (c) D < E < C < A < B (d) A < E < D < C < B

82. Homolytic fission of the following alkanes forms free radicals CH$_3$ – CH$_3$, CH$_3$ – CH$_2$ – CH$_3$, (CH$_3$)$_2$ CH – CH$_3$, CH$_3$ – CH$_2$ – CH (CH$_3$)$_2$. Increasing order of stability of the radicals is [NEET Kar. 2013]

(a) (CH$_3$)$_3$C < (CH$_3$)$_2$C – CH$_2$CH$_3$ < CH$_3$ – C – CH – CH$_3$ < (CH$_3$)$_2$C – CH (CH$_3$)$_2$

(b) (CH$_3$)$_3$C < (CH$_3$)$_2$C – CH$_2$CH$_3$ < CH$_3$ – C – CH – CH$_3$ < (CH$_3$)$_2$C – CH (CH$_3$)$_2$

(c) CH$_3$ – C – CH – CH$_3$ < (CH$_3$)$_3$C < (CH$_3$)$_2$C – CH$_2$CH$_3$ < CH$_3$ – C – CH – CH$_3$ < (CH$_3$)$_2$C – CH (CH$_3$)$_2$

(d) CH$_3$ – C – CH – CH$_3$ < (CH$_3$)$_3$C < (CH$_3$)$_2$C – CH$_2$CH$_3$ < (CH$_3$)$_3$C

83. What is the hybridisation state of benzyl carbonium ion $\text{\includegraphics{C6H5}}\text{CH}_2^+$? [NEET Kar. 2013]

(a) $sp^3$ (b) $sp^2$ (c) $sp^2d$ (d) $sp^2d^2$
84. Nitrogen detection in an organic compound is carried out by Lassaigne’s test. The blue colour formed corresponds to which of the following formulae? \[
\text{[NEET Kar. 2013]}
\]
(a) \(\text{Fe}_3[\text{Fe(CN)}_6]_3\)
(b) \(\text{Fe}_3[\text{Fe(CN)}_6]_2\)
(c) \(\text{Fe}_4[\text{Fe(CN)}_6]_3\)
(d) \(\text{Fe}_4[\text{Fe(CN)}_6]_2\)

85. Among the following compounds the one that is most reactive towards electrophilic nitration is:
\[
\text{[2012]}
\]
(a) Benzoic acid (b) Nitrobenzene (c) Toluene (d) Benzene

86. Which one of the following is most reactive towards electrophilic reagent?
\[
\text{[2011]}
\]
(a) \(\text{CH}_3\text{OCH}_3\) (b) \(\text{CH}_3\text{OH}\) (c) \(\text{CH}_3\text{NHCOCH}_3\) (d) \(\text{CH}_3\text{CH(OH)}\text{CN}\)

87. The correct order of increasing bond length of \(\text{C} – \text{H}, \text{C} – \text{O}, \text{C} – \text{C}\) and \(\text{C} = \text{C}\) is:
\[
\text{[2011]}
\]
(a) \(\text{C} – \text{H} < \text{C} – \text{O} < \text{C} – \text{C} < \text{C} = \text{C}\)
(b) \(\text{C} – \text{C} < \text{C} – \text{O} < \text{C} – \text{H} < \text{C} = \text{C}\)
(c) \(\text{C} – \text{O} < \text{C} – \text{H} < \text{C} – \text{C} < \text{C} = \text{C}\)
(d) \(\text{C} – \text{H} < \text{C} – \text{O} < \text{C} – \text{C} < \text{C} = \text{C}\)

88. Which one is a nucleophilic substitution reaction among the following?
\[
\text{[2011]}
\]
(a) \(\text{CH}_3 – \text{CH} = \text{CH}_2 + \text{H}_2\text{O} \rightarrow \text{CH}_3 – \text{CH} – \text{CH}_3\)
(b) \(\text{RCHO} + \text{R’MgX} \rightarrow \text{R} – \text{CH} – \text{R’}\)
(c) \(\text{CH}_3 – \text{CH}_2 – \text{CH} – \text{CH}_2\text{Br} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2\)
(d) \(\text{CH}_3\text{CHO} + \text{HCN} \rightarrow \text{CH}_3\text{CH(OH)}\text{CN}\)

89. Which of the following compounds undergoes nucleophilic substitution reaction most easily?
\[
\text{[2011 M]}
\]
(a) \(\text{CH}_3\text{COOCH}_3\) (b) \(\text{CH}_3\text{CONH}_2\) (c) \(\text{CH}_3\text{COOCOCH}_3\) (d) \(\text{CH}_3\text{COCl}\)

90. In Duma’s method of estimation of nitrogen 0.35 g of an organic compound gave 55 mL of nitrogen collected at 300 K temperature and 715 mm pressure. The percentage composition of nitrogen in the compound would be:
\[
\text{[2011]}
\]
(a) 15.45 (b) 16.45 (c) 17.45 (d) 14.45

91. The Lassaigne’s extract is boiled with conc. \(\text{HNO}_3\) while testing for halogens. By doing so it
\[
\text{[2011]}
\]
(a) decomposes \(\text{Na}_2\text{S}\) and \(\text{NaCN}\), if formed.
(b) helps in the precipitation of \(\text{AgCl}\).
(c) increases the solubility product of \(\text{AgCl}\).
(d) increases the concentration of \(\text{NO}_3^-\) ions.

92. Given are cyclohexanol (I) acetic acid (II), 2, 4, 6 – trinitrophenol (III) and phenol (IV). In these the order of decreasing acidic character will be:
\[
\text{[2010]}
\]
(a) III > II > IV > I (b) II > III > I > IV (c) II > III > IV > I (d) III > IV > II > I

93. The correct order of increasing reactivity of \(\text{C} – \text{X}\) bond towards nucleophile in the following compounds is:
\[
\text{[2010]}
\]
(I) \(\text{NO}_2\) (II) \(\text{CH}_3\) (III) \(\text{CH}_3\text{COOCOCH}_3\) (IV) \(\text{CH}_3\text{CONH}_2\)

(a) I < II < IV < III (b) II < III < I < IV (c) IV < III < I < II (d) III < II < I

94. Among the given compounds, the most susceptible to nucleophilic attack at the carbonyl group is:
\[
\text{[2010]}
\]
(a) \(\text{CH}_3\text{COOCH}_3\) (b) \(\text{CH}_3\text{CONH}_2\) (c) \(\text{CH}_3\text{COOCOCH}_3\) (d) \(\text{CH}_3\text{COCl}\)
95. Which one is most reactive towards electrophilic reagent? 
(a) CH₃OH  
(b) CH₃CH₂OH  
(c) CH₃NHCOCH₃  
(d) CH₃OCH₃

96. Which of the following species is not electrophilic in nature? 
(a) NO₂⁺  
(b) Cl⁻  
(c) BH₃  
(d) H₂O

97. Which one of the following is most reactive towards electrophilic attack? 
(a) CH₂OH  
(b) NO₂  
(c) OH⁻  
(d) Cl⁻

98. Base strength of: 
(A) H₂C−CH₂  
(B) H₂C=CH and  
(C) H−C≡C  
is in the order of: 
(a) (B) > (A) > (C)  
(b) (C) > (B) > (A)  
(c) (A) > (C) > (B)  
(d) (A) > (B) > (C)

99. A strong base can abstract an α-hydrogen from: 
(a) alkene  
(b) amine  
(c) ketone  
(d) alkane

100. The stability of carbanions in the following: 
(a) RC=CH⁻  
(b)  
(c) R₂C=CH⁻  
(d) R₃C−CH₂  
is in the order of: 
(a) (a) > (b) > (c) > (d)  
(b) (b) > (c) > (d) > (a)  
(c) (d) > (b) > (c) > (a)  
(d) (a) > (c) > (b) > (d)

101. Consider the following compounds. 
(i) C₆H₅COCl  
(ii) O₃N−COCl  
(iii) H₄C−COCl  
(iv) OHC−COCl  
The correct decreasing order of their reactivity towards hydrolysis is 
(a) (i) > (ii) > (iii) > (iv)  
(b) (ii) > (i) > (iii) > (iv)  
(c) (ii) > (iv) > (i) > (iii)  
(d) (ii) > (iv) > (iii) > (i)

102. For (i) I⁻, (ii) Cl⁻, (iii) Br⁻, the increasing order of nucleophilicity would be 
(a) Cl⁻ < Br⁻ < I⁻  
(b) I⁻ < Cl⁻ < Br⁻  
(c) Br⁻ < Cl⁻ < I⁻  
(d) I⁻ < Br⁻ < Cl⁻

103. The order of decreasing reactivity towards an electrophilic reagent, for the following would be: 
(i) benzene  
(ii) toluene  
(iii) chlorobenzene  
(iv) phenol  
(a) (ii) > (iv) > (i) > (iii)  
(b) (iv) > (iii) > (ii) > (i)  
(c) (iv) > (ii) > (i) > (iii)  
(d) (i) > (ii) > (iii) > (iv)

104. Which of the following undergoes nucleophilic substitution exclusively by S_N^1 mechanism? 
(a) Ethyl chloride  
(b) Isopropyl chloride  
(c) Chlorobenzene  
(d) Benzyl chloride

105. Which amongst the following is the most stable carbocation? 
(a)  
(b)  
(c)  
(d)  

106. Which one of the following compounds is most acidic? 
(a) Cl−CH₂−CH₂−OH  
(b)  


107. The best method for the separation of naphthalene and benzoic acid from their mixture is [2005]
(a) distillation  (b) sublimation  
(c) chromatography  (d) crystallisation

108. Which of the following is least reactive in a nucleophilic substitution reaction. [2004]
(a) ClC\(_3\)CH\(_3\)\(^-\)  
(b) CHCl\(_2\)CH\(_2\)=  
(c) ClCH\(_2\)CH\(_3\)\(^-\)  
(d) ClCH\(_2\)CH\(_2\)=

109. The correct order of reactivity towards the electrophilic substitution of the compounds aniline (I), benzene (II) and nitrobenzene (III) is [2003]
(a) I > II > III  
(b) III > II > I  
(c) II > III > I  
(d) I < II > III

110. Which one of the following is a free-radical substitution reaction? [2003]
(a) CH\(_3\)CHO + HCN $\xrightarrow{\text{Boiling}}$ CH\(_3\)CH(OH)CN  
(b) 
(c) 
(d) 

111. The correct order of acidic strength for following compounds will be [2001]
(a) III > I > II  
(b) I > III > II  
(c) II > III > I  
(d) I > II > III

112. In steam distillation of toluene, the pressure for toluene in vapour is [2001]
(a) Equal to pressure of barometer  
(b) Less than pressure of barometer  
(c) Equal to vapour pressure of toluene in simple distillation  
(d) More than vapour pressure of toluene in simple distillation

113. Which of the following compounds reacts slower in electrophilic substitution? [2000]
(a) \(\text{C}_6\text{H}_5\text{NO}_2\)  
(b) \(\text{C}_6\text{H}_5\text{OH}\)  
(c) \(\text{C}_6\text{H}_5\text{CH}_3\)  
(d) \(\text{C}_6\text{H}_5\text{NH}_2\)

114. Consider the following phenols:

The decreasing order of acidity of the above phenols is [1999]
(a) III > IV > II > I  
(b) II > I > IV > III  
(c) I > IV > II > III  
(d) III > IV > I > II

115. Which one of the following compounds will be most easily attacked by an electrophile? [1998]
(a) 
(b) 
(c) 
(d) 

116. Which one of the following compounds is resistant to nucleophilic attack by hydroxyl ions? [1998]
(a) Methyl acetate  
(b) Acetonitrile  
(c) Diethyl ether  
(d) Acetamide

117. Which one of the following order is correct regarding the – I effect of the substituents? [1998]
(a) \(-\text{NR}_2 < -\text{OR} < -\text{F}\)  
(b) \(-\text{NR}_2 > -\text{OR} < -\text{F}\)  
(c) \(-\text{NR}_2 < -\text{OR} < -\text{F}\)  
(d) \(-\text{NR}_2 > -\text{OR} < -\text{F}\)
118. Which one of the following is a technique most suitable for purification of cyclohexanone from a mixture containing benzoic acid, isoamyl alcohol, cyclohexane and cyclohexanone? [1997]
(a) Crystallization
(b) Sublimation
(c) IR spectroscopy
(d) Gas chromatography

119. The reaction:
\[
\begin{align*}
\text{HO} & \quad \text{–} \\
\text{–} & \quad \text{–} \\
\text{C} & \quad \text{Br} \\
\text{H}_3 & \quad \text{C} \\
\text{C} & \quad \text{H}_3
\end{align*}
\]
is described as [1997]
(a) S\text{E}2
(b) S\text{N}1
(c) S\text{N}0
(d) S\text{N}2

120. Which one of these is not compatible with arenes? [1997]
(a) Greater stability
(b) Delocalisation of \(\pi\)-electrons
(c) Electrophilic additions
(d) Resonance

121. Among the following compounds (I-III), the ease of their reaction with electrophiles is, [1997]
(a) II > III > I
(b) III > II > I
(c) II > I > III
(d) I > II > III

122. Decreasing order of reactivity towards nucleophilic addition to carbonyl group among cyclopentanone, 3-pentanone and n-pentanal is [1996]
(a) 3-pentanone, cyclopentanone, n-pentanal
(b) n-pentanal, 3-pentanone, cyclopentanone
(c) n-pentanal, cyclopentanone, 3-pentanone
(d) cyclopentanone, 3-pentanone, n-pentanal

123. Correct increasing order of acidity is as follows: [1994]
(a) \(\text{H}_2\text{O}, \text{C}_2\text{H}_5, \text{H}_2\text{CO}_3\), Phenol
(b) \(\text{C}_2\text{H}_5, \text{H}_2\text{O}, \text{H}_2\text{CO}_3\), Phenol
(c) Phenol, \(\text{C}_2\text{H}_5, \text{H}_2\text{CO}_3, \text{H}_2\text{O}\)
(d) \(\text{C}_2\text{H}_5, \text{H}_2\text{O}, \text{Phenol, H}_2\text{CO}_3\)

124. An example of electrophilic substitution reaction is [1994]
(a) Chlorination of methane
(b) Conversion of methyl chloride to methyl alcohol
(c) Nitration of benzene
(d) Formation of ethylene from ethyl alcohol.

125. Lassaigne’s test for the detection of nitrogen fails in [1994]
(a) \(\text{NH}_2\text{CONHNH}_2\cdot\text{HCl}\)
(b) \(\text{NH}_2\text{NH}_2\cdot\text{HCl}\)
(c) \(\text{NH}_2\text{CONH}_2\)
(d) \(\text{C}_6\text{H}_5\text{NHNH}_2\cdot\text{HCl}\)

126. The most suitable method for separation of a 1 : 1 mixture of ortho and para nitrophenols is [1994]
(a) Sublimation
(b) Chromatography
(c) Crystallization
(d) Steam distillation

127. A is a lighter phenol and B is an aromatic carboxylic acid. Separation of a mixture of A and B can be carried out easily by using a solution of [1992]
(a) Sodium hydroxide
(b) Sodium sulphate
(c) Calcium chloride
(d) Sodium bicarbonate

128. The most reactive compound for electrophilic nitration is [1992]
(a) Benzene
(b) Nitrobenzene
(c) Benzoic acid
(d) Toluene.

129. Which of the following is the most stable carbocation (carbonium ion)? [1991]
(a) \(\text{CH}_3\text{CH}_2^+\)
(b) \(\text{(CH}_3)_2\text{CH}^+\)
(c) \(\text{(CH}_3)_3\text{C}^+\)
(d) \(\text{C}_6\text{H}_5\text{C}^+\text{H}_2\)

130. In sodium fusion test of organic compounds, the nitrogen of the organic compound is converted into [1991]
(a) Sodamide
(b) Sodium cyanide
(c) Sodium nitrite
(d) Sodium nitrate

131. Kjeldahl’s method is used in the estimation of [1990]
(a) Nitrogen
(b) Halogens
(c) Sulphur
(d) Oxygen

132. Lassaigne’s test is used in qualitative analysis to detect [1989]
(a) Nitrogen
(b) Sulphur
(c) Chlorine
(d) All of these
Hints & Solutions

1. (d) \( \text{CHO} \)  
   \[ \text{3-keto-2-methylhex-4-enal} \]
   Aldehydes get higher priority over ketone and alkene in numbering of principal carbon chain.

2. (a) \( \text{CH}_3\text{C}=\text{C} \bullet \text{OH} \)  
   IUPAC name of the structure is 3-ethyl-2-hydroxy-4-methylhex-3-en-5-ynoic acid.

3. (d) \( \text{CH}_3\text{C}-\text{CH}_2- \) (isobutyl group)

4. (a) \( \text{BrCH}_2\text{CH}_2\text{CH} = \text{CH}_2 \)
   The correct name is 3-Bromoprop-1-ene.

5. (a) The given compound is
   \[ \text{CH}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{C} - \text{CH}_2 - \text{CH}_3 \]
   4 ethyl – 3-propyl hex – 1 – ene

6. (a) \( \text{Cl} \)  
   Correct IUPAC name of above compound is trans-2-chloro-3-iodo-2-pentene.

7. (d) \( \text{CH}_3\text{C} \)  
   \[ \text{sp}^3 \]  
   \[ \text{sp}^2 \]  
   \[ \text{C} = \text{O} \]
   Thus the correct sequence is \( \text{sp}, \text{sp}^3, \text{sp}^2 \).

8. (b) C – 1 is \( \text{sp} \) hybridized \( (\text{C} = \text{C}) \)
   C – 3 is \( \text{sp}^3 \) hybridized \( \text{(C–C)} \)
   C – 5 is \( \text{sp}^2 \) hybridized \( \text{(C = C)} \)
   Thus the correct sequence is \( \text{sp}, \text{sp}^3, \text{sp}^2 \).

9. (c) General molecular formula of alkanols is \( \text{C}_n\text{H}_{2n+2}\text{O} \), \( \text{(C}_n\text{H}_{2n+1}\text{OH}) \)

10. (c) \( \text{CH} = \text{C} \)  
    It is \( 2,3\text{-dimethylpentanoyl chloride.} \)

11. (a) Among the three given hybrid orbitals, \( \text{sp} \) hybrid orbital is most electronegative.
    Contribution of \( s \) in \( \text{sp} \) hybrid orbital is maximum (50%) so this orbital is closer to nucleus. Naturally
it will have greater tendency to pull electron towards it. Hence it becomes more electronegative and sp\(^3\) becomes least electronegative as it has only 25% s-character.

12. (a) Correct IUPAC name of

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_2\text{CH}_2 - \quad \text{CH} - \quad \text{CH} - \quad \text{CH}_2\text{CH}_3
\end{align*}
\]

is 4-Ethyl-3-methylheptane

13. (b) The IUPAC name of

\[
\begin{align*}
1 & \quad 2 & \quad 3 & \quad 4 & \quad 5 & \quad 6 \\
\text{CH}_3 & \quad 2 & \quad \text{CH} & \quad \text{CH} & \quad \text{CH}_3 & \quad \text{CH}_3 \\
& & & & & \text{CH}_3 \\
& & & & & \text{CH}_3 \\
\end{align*}
\]

is Hex-1-en-5-yne or 1-hexene-5-yne

The lowest number is given to the C = C double bond.

14. (a) \(\text{CH}_3\) \(\text{C} - \text{CH} - \text{CH}_3\)

3 Methyl-2-butanone

1 \(\text{CH}_3\) \(\text{CH} - \text{CH} - \text{CH}_3\)

2, 3 dimethyl pentane

2 \(\text{CH}_3\) \(\text{CH} - \text{CH}_3\)

2 Bromo-3-chlorobutane

1 \(\text{CH}_3\) \(\text{C} \equiv \text{C} - \text{CH} - \text{CH}_3\)

4-Methyl-2-pentyne

16. (c) \(\text{CH}_3\) \(\text{C} \equiv \text{C} - \text{CH} - \text{CH}_3\)

2-Methyl-2-butene

17. (c) \(\text{H}_3\) \(\text{C} \equiv \text{C} - \text{CH} - \text{CH}_3\)

2-Methyl-2-butene

18. (b) When many substituents are present, the numbering is done from the end where the sum of locants is the lowest (lowest sum rule)

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH} - \quad \text{CH} - \quad \text{CH} - \quad \text{CH}_2 - \quad \text{CH}_2 - \quad \text{CH} - \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_3 & \quad \text{CH}_3
\end{align*}
\]

2, 5, 6-trimethylheptane (wrong)

\[
\begin{align*}
\text{CH}_3 - & \quad \text{CH} - \quad \text{CH} - \quad \text{CH}_2 - \quad \text{CH}_2 - \quad \text{CH} - \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_3 & \quad \text{CH}_3
\end{align*}
\]

2 + 3 + 6 = 11

2, 3, 6-trimethylheptane (correct)

19. (d) Huckel’s rule states that for aromaticity there must be \((4n + 2)\) \(\pi\) electrons present in a compound, where \(n\) is an integer.

20. (c) The vital force theory suffered first death blow in 1828 when Wohler synthesized the 1st organic compound urea in the laboratory from inorganic compounds reported below:

\[
\begin{align*}
\text{NH}_4\text{CNO} & \xrightarrow{\text{rearrangement leading to isomeric charge}} \text{NH}_2\text{CONH}_2 \\
\text{Urea}
\end{align*}
\]

Later on a further blow to vital force theory was given by Kolbe (1845) who prepared acetic acid, the first organic compound, in laboratory from its elements.

21. (b) \(\text{CH}_3 - \quad \text{CH} - \quad \text{CH} - \quad \text{CH}_2 - \quad \text{CH}_3\)

3-Ethyl-2-methylpentane

22. (d) Resonance structures are separated by a double headed arrow (\(\xrightarrow{\text{\(\|\)}}\))

23. (d) Angle increases progressively

\(\text{sp}^3\) (109°28'), \(\text{sp}^2\) (120°), \(\text{sp}\) (180°)

24. (b) \(\text{CH}_3 - \quad \text{CH} - \quad \text{CH} - \quad \text{CH}_2 - \quad \text{CH}_3\)

4-Hydroxy-2-methylpent-2-en-1-al

25. (b) \(\text{CH}_3 - \quad \text{CH} - \quad \text{CH} - \quad \text{CH}_2 - \quad \text{CH}_3\)

2-Methyl-2-butene
26. (d) $\text{CH}_3\text{CH} = \text{CH}_2 \rightarrow \text{CH} = \text{C} \equiv \text{CH}$

27. (a) $\text{sp}^3$ orbital has $\frac{1}{4}(25\%)$ s-character & 75\% p-character.

28. (d) Shortest C – C distance (1.20 Å) is in acetylene, as acetylene has sp hybridisation. The bond length increases in the order

$$\text{C} = \text{C} \ < \text{C} = \text{C} \ < \text{C} – \text{C}$$

29. (a) $\text{sp}^2$ or $\text{sp}^3$

Hence it is homocyclic (as the ring system is made of one type of atoms, i.e. carbon) but not aromatic. As it does not follow (4n +2)π electron rule of aromaticity.

30. (c) $\text{CH}_2 = \text{C} = \text{H}_2$

31. (d) All the properties mentioned in the question suggest that it is a benzene molecule. Since in benzene all carbons are $\text{sp}^2$-hybridized, therefore, $\text{C} – \text{C} – \text{C} \angle$ is 120°

32. (d) Tetrachloroethene being an alkene has $\text{sp}^2$-hybridized C= atoms and hence the angle Cl – C – Cl is 120° while in tetrachloromethane, carbon is $\text{sp}^3$ hybridized, therefore the angle Cl – C – Cl is 109.5°.

33. (b) is optically active due to absence of plane of symmetry and center of symmetry.

34. (d) In staggered conformation any two hydrogen atoms on adjacent carbon atoms are as far apart as possible there by minimising repulsion between the electron clouds of $\sigma$-bonds of two non-bonded H-atomic (torsional strain)

35. (c) Four different Substituent, only one chiral centre. Hence only enantiomers are possible.

36. (c) All of these compounds show tautomerism

37. (c) Conformers are form of stereoisomers in which isomers can be interconverted by rotation about single bonds. I and II are staggered and eclipsed conformers respectively.

38. (a) maleic acid

It shows geometrical isomerism but does not show optical isomerism.
39. (b) The bulky methyl groups are maximum away from each other.
40. (a) Due to hydrogen bonding between the two OH groups, gauche conformation of ethylene glycol (a) is the most stable conformation.

\[ \text{cis-But-2-ene} \]
\[ \text{trans-But-2-ene} \]

41. (d) Alkenes with double bonds cannot undergo free rotation and can have different geometrical shapes with two different groups on each end of the double bond.

\[
\text{CH}_3 \text{C} = \text{C} \text{CH}_2 \text{CH}_3
\]

42. (a) In the molecule \( \text{CH}_3 \text{CH} = \text{CHCH}_2 \text{CH} - \text{CH}_3 \), the number of stereoisomers is given by sum of geometrical isomers (because of presence of \( \text{C} = \text{C} \)) and optical isomers (because of presence of chiral carbon atom).

Number of geometrical isomers = 2 (one \( \text{C} = \text{C} \) is present).

Number of optical isomers = 2 (one chiral carbon atom).

Total number of stereoisomers = \( 2 + 2 = 4 \)

43. (a) Compounds which do not show optical activity inspite of the presence of chiral carbon atoms are called \textit{meso}-compounds. The absence of optical activity in these compound is due to the presence of a plane of symmetry in their molecules. e.g. meso-tartaric acid is optically inactive.

44. (b) \( \text{Cl} - \text{C} - \text{CH}_3 \)

45. (b)

\[
\begin{align*}
\text{(a) } & \quad \text{Br} - \text{C} - \text{C} - \text{C} - \text{C} - \text{Br} & \text{[Chiral]} \\
\text{(b) } & \quad \text{Br} - \text{C} - \text{C} - \text{C} - \text{C} - \text{OH} & \text{[Not chiral]} \\
\text{(c) } & \quad \text{Br} - \text{C} - \text{C} - \text{COOH} & \text{[Chiral]} \\
\text{(d) } & \quad \text{Br} - \text{C} - \text{C} - \text{COOH} & \text{[Chiral]}
\end{align*}
\]

*marked are chiral carbons.

46. (a) Clockwise rotation.

Hence configuration is R.

If the eye travel in a clockwise direction, the configuration is (R) as the order of priority is \( \text{Br} > \text{Cl} > \text{CH}_3 > \text{H} \).

47. (b) Optical and geometrical isomerism pair up to exhibit stereoisomerism. This is because the isomers differ only in their orientation in space.

48. (a) \( \text{HO} - \text{C} - \text{H} \)

\( \beta - \text{D} -(+)- \text{Glucose} \)

Carbon atoms from \( \text{C}_1 \) to \( \text{C}_5 \) are chiral
49. (b) In diphenylmethane monochlorination at following positions will produce structured isomers

![Chemical structure](image1)

50. (b) Compound which are mirror image of each other and are not superimposable are termed as enantiomers.

![Chemical structure](image2)

53. (a) A compound is said to exhibit optical isomerism if it at least contains one chiral carbon atom, which is an atom bonded to 4 different atoms or groups.

![Chemical structure](image3)

54. (b) Stability of an alkene depends upon the heat of hydrogenation of an alkene. The lower the heat of hydrogenation of an alkene higher will be stability.

**Order of stability**

<table>
<thead>
<tr>
<th>Compound</th>
<th>Heat of hydrogenation (kJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>trans-2-butene</td>
<td>115.5</td>
</tr>
<tr>
<td>cis-2-butene</td>
<td>119.6</td>
</tr>
<tr>
<td>1-butene</td>
<td>126.8</td>
</tr>
</tbody>
</table>

55. (a) When similar atoms are on the opposite side, the compound is in *trans*-form.

![Chemical structure](image4)

56. (c) Chiral molecules are those molecules which have at least one symmetric carbon atom (a carbon atom attached to 4 different groups). This is true in case of 3-methylpentanoic acid.

![Chemical structure](image5)

57. (a) Due to absence of a symmetric (chiral) C-atom. D → CH₂ — CH₂ — CH₂Cl molecule is not a chiral molecule.

58. (d) Tautomerism is exhibited by the oscillation of hydrogen atom between two polyvalent atoms present in the molecule. As option (d) has α-hydrogen atom. Therefore it shows tautomerism whereas other structures do not.

![Chemical structure](image6)

59. (c) Order of stability: staggered (anti) > gauche > skew boat > eclipsed.

Newman projection of n-butane is given as

![Newman projection](image7)
The staggered conformation is most stable in which methyl groups are far apart as far as possible, due to minimum repulsion between methyl groups and is also called anti conformation.

Due to presence two similar methyl group at same carbon atom, above compound doesn’t show geometrical isomerism.

Due to presence of four different groups on carbon, (C*) it is chiral.

The possible isomers of the compound with molecular formula $C_7H_8O$ is 5. These are $\text{C}_6\text{H}_5\text{OCH}_3$, $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$ and

$\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

Due to presence of four different groups on carbon, (C*) it is chiral.

The compound containing a chiral carbon atom i.e., (a carbon atom which is attached to four different substituents is known as a chiral carbon atom) is optically active.

Steam distillation is the most suitable method of separation of 1 : 1 mixture of ortho and para nitrophenols as there is intramolecular hydrogen bonding in o-nitrophenol.
74. (b) Only structure (III) has H in conjugation with free radical. So, hyperconjugation is possible in III only.

75. (b) π bond is transferred after leaving Cl

\[
\begin{align*}
\text{CH}_3 - \text{CH} = \text{CHCH}_2 - \overset{\ominus}{\text{Cl}} & \rightarrow \text{CH}_3 - \text{CH} = \text{CH-CH}_2 - \overset{\ominus}{\text{Cl}} \\
\text{CH}_3 - \text{CH} & \rightarrow \text{CH} = \text{CH}_2
\end{align*}
\]

76. (b) Wt. of organic substance = 0.25 g

\[
\begin{align*}
V_1 &= 40 \text{ mL}, \quad T_1 = 300 \text{ K} \\
P_1 &= 725 - 25 = 700 \text{ mm of Hg} \\
P_2 &= 760 \text{ mm of Hg (at STP)} \\
T_2 &= 273 \text{ K} \\
\frac{P_1 V_1}{T_1} &= \frac{P_2 V_2}{T_2}
\end{align*}
\]

V_2 (Volume of nitrogen at STP)

\[
\frac{273 \times 700 \times 40}{300 \times 760} = 33.52 \text{ mL}
\]

Percentage of nitrogen

\[
\frac{28 \times \text{volume of N}_2 \text{ at STP} \times 100}{\text{wt. of organic substance}} = \frac{28 \times 33.52 \times 100}{22400 \times 0.25} = 16.76\%
\]

77. (N) Out of the given four compounds only (iv) compound is chiral and hence only this compound will undergo racemisation. Therefore none of the given option is correct.

78. (a) 10 ml, 1 M H_2SO_4 = 20 ml, 1 M NH_3

\[
\begin{align*}
\therefore \quad \text{wt of N in one mole NH}_3 &= 14 \\
\therefore \quad 20 \times 10^{-3} \text{ mol NH}_3 &\rightarrow 20 \times 10^{-3} \times 14 \text{ nitrogen} \\
\therefore \quad 0.75 \text{ g of sample contains} &= \frac{14 \times 20 \times 10^{-3}}{0.75} \times 100 = 37.33\%
\end{align*}
\]

79. (c) Decreasing order of deactivating effect of the given m-directing group is

\[
\begin{align*}
> \text{NO}_2 > -\text{CN} > -\text{SO}_2\text{H} > -\text{COOH}
\end{align*}
\]

-NO_2 group is most deactivating group due to strong – E, –I and –M effects.

80. (b) –NO_2 is a powerful electron withdrawing group. Its presence on ring makes the ring less active.

81. (b) Greater the number of e\(^{-}\) donating alkyl groups (+I effect), greater will be the stability of carbenes.

82. (c) Stability depends on number of hyperconjugative structure.

83. (b) In the carbenion ion the carbon atom carrying the positive charge is sp\(^2\) hybridized.

84. (c) The prussian blue colour is of Fe_4[Fe(CN)]_6 ferric ferrocyanide

85. (c) Electrophilic rate order

\[
\begin{align*}
\text{Toluene} > \text{Benzoic acid} > \text{Nitrobenzene}
\end{align*}
\]

Since nitration is an electrophilic substitution hence presence of electron releasing group like CH_3 in the nucleus facilitates nitration.

86. (b) Due to + M effect of – OH group and hyperconjugation of – CH_3 group.

87. (a) Bond length order is

\[
\begin{align*}
\text{C – H} < \text{C – C} \quad \text{C – O} < \text{C – C} \\
1.10\text{Å} < 1.34\text{Å} \quad 1.40\text{Å} < 1.54\text{Å}
\end{align*}
\]

88. (c) Because of high electronegativities of the halogen atom, the carbon halogen (C – X) is highly polarised covalent bond. Thus, the carbon atom of the C – X bond becomes a good site for attack by nucleophiles (electron rich species). Nucleophilic substitution reactions are the most common reactions of alkyl halides.

89. (a) In S_N reactions, a carbanion is formed as an intermediate, so any substituent that increases the stability of carbanion and hence the transition state leading to its formation will enhance the S_N reactions.

To compare the rates of substitution, in chlorobenzene, electron-withdrawing group, and chlorobenzene having electron-releasing group, we compare the structures carbanion I (from chlorobenzene), II (from chlorobenzene containing electron-withdrawing group) and III (from chlorobenzene containing electron-releasing group).

\[
\begin{align*}
\text{I} &\quad \text{Z} &\quad \text{Cl} \\
\text{II} &\quad \text{G} &\quad \text{Cl} \\
\text{III} &\quad \text{-} &\quad \text{-}
\end{align*}
\]

G withdraws electrons, neutralises (disperses) –ve charge of the ring, stabilises carbanion, facilitates S_N reaction (activation effect)
G releases electrons, intensifies –ve charge, destabilizes carbanion, retards $S_N$ reaction (deactivation)

NO$_2$ is activating group and CH$_3$ and OCH$_3$ are deactiving group.

Hence, the correct order of nucleophilic substitution reaction is:

\[
\begin{align*}
\text{Cl} \quad & < \quad \text{NO}_2 \quad & > \quad \text{CH}_3 \quad & > \quad \text{OCH}_3
\end{align*}
\]

90. (b) Given wt of compound taken (w) = 0.35 g
Volume of nitrogen collected (V) = 55 ml
Room temperature (t K) = 300 K
Atmospheric pressure (P) = 715 mm
Aq. tension ($\rho$) = 15 mm
Calculation -
Volume of N$_2$ at NTP
\[
= \frac{(P - \rho) \times V}{t} \times \frac{273}{760} \text{ ml}
\]
\[
= \frac{(715 - 15) \times 55}{300} \times \frac{273}{760} = 46.098 \text{ ml}
\]
% of nitrogen
\[
= \frac{28 \times \text{vol.of N}_2 \text{ at NTP} \times 100}{22400 \times \text{wt of organic compound}}
\]
\[
= \frac{28 \times 46.098 \times 100}{22400 \times 0.35} = 16.46\%
\]

91. (a) Conc. HNO$_3$ decomposes NaCN and Na$_2$S to avoid their interference.
NaCN + HNO$_3$ $\rightarrow$ NaNO$_3$ + HCN ↑
Na$_2$S + 2HNO$_3$ $\rightarrow$ 2NaNO$_3$ + H$_2$S ↑

92. (a) N$_2$O$_4$ > CH$_3$COOH >

93. (a) Tertiary alkyl halide is most reactive towards nucleophilic substitution because the corresponding carbocation ($3^\circ$) is most stable. Aryl halide is least reactive due to partial double bond character of the C – Cl bond. Presence of — NO$_2$ groups in ortho and para positions increases the reactivity of the – Cl towards nucleophiles.

\[
\begin{align*}
\text{(III)} & \quad > \quad \text{(IV)} & \quad > \quad \text{(II)} & \quad > \quad \text{(I)}
\end{align*}
\]

Explanation: Presence of three — NO$_2$ groups in $o$–, $p$– positions to phenolic groups (in III) makes phenol strongly acidic because its corresponding phenate ion (conjugate base) is highly stabilised due to resonance. Conjugate base of CH$_3$COOH, II ($i.e.$ CH$_3$COO$^-$) is resonance hybrid of two equivalent structures. The conjugate base of phenol, IV is stabilized due to resonance (note that here all resonating structures are not equivalent). The conjugate base of cyclohexanol, I does not exhibit resonance, hence not formed.

94. (d) Cl$^-$ is the weakest base and hence better leaving group.

95. (d) CH$_3$OCH$_3$

Among –OH, –CH$_2$OH, –NHCOCH$_3$, and –OCH$_3$, methoxy group has the highest +M effect.

96. (d) $\text{H}_3\text{O}^+\left\{\begin{array}{c} \text{H} \\ \text{H} - \text{O}^\bullet - \text{H} \end{array}\right\}$ has a lone pair of electrons on oxygen atom, thus it is not an electrophile. Also the octet is complete.
97. (c) Out of the given compounds the most reactive towards nucleophilic attack is

\[
\text{Phenoxide ion is stable due to resonance.}
\]

98. (d) The amount of \( s \)-character in various hybrid orbitals is as follows.

\[
s_p = 50\%, \quad s_{p^2} = 33\% \quad \text{and} \quad s_{p^3} = 25\%
\]

Therefore \( s \)-character of the \( C - H \) bond in acetylene (\( sp \)) is greater than that of the \( C - H \) bond in alkene (\( sp^2 \) hybridized) which in turn has greater \( s \)-character of the \( C - H \) bond in alkanes. Thus owing to a high \( s \)-character of the \( C - H \) bond in alkanes, the electrons constituting this bond are more strongly held by the carbon nucleus with the result the hydrogen present on such a carbon atom can be easily removed as proton. The acidic nature of three types of \( C - H \) bonds follows the following order

\[
\equiv C - H > \equiv C - H > C - H
\]

Further, as we know that conjugate base of a strong acid is a weak base, hence the correct order of basicity is

\[
H - C \equiv C < \text{CH}_2 < \text{CH} < \text{CH}_2 - \text{CH}_3
\]

99. (c) A strong base can abstract an \( \alpha \)-hydrogen from a ketone.

100. (d) The stability of carbanions is affected due to resonance, inductive effect and \( s \)-character of orbitals. Greater the number of groups having +I group (alkyl group) lesser stable would be the carbanion.

Further stability of carbanion decreases with decrease in \( s \)-character. Benzene carbanions are stabilized due to resonance, hence the correct order is

\[
R - C = \text{C} \equiv \text{R}_2 \equiv \text{CH} > \text{R}_3 \equiv \text{C} - \text{CH}_2
\]

The correct order of stability of given carbanion is in the order \( a > c > b > d \).

101. (c) The degree of hydrolysis increases as the magnitude of positive charge on carbonyl group increases. Electron withdrawing group increases the positive charge and electron releasing group decreases the positive charge. Among these \( \text{NO}_2 \) & \( \text{CHO} \) are electron withdrawing group from which \( \text{NO}_2 \) exhibit more –I effect than –CHO. On the other hand \( \text{CH}_3 \) is a electron releasing group therefore the order of reactivity towards hydrolysis is

\[
\text{COCI} > \text{COCI} > \text{COCI} > \text{COCI}
\]

102. (a) Nucleophilicity increases down the periodic table: \( \Gamma^- > \text{Br}^- > \text{Cl}^- > \text{F}^- \)

103. (c) Electrophiles have high affinity for electrons. They attack at the site where electron-density is highest. Electron donating groups increases the electron density. The electron donating tendency decreases in the order:

\[
\text{–OH} > \text{–CH}_3 > \text{–H} > \text{–Cl}
\]

Therefore, the correct order of reactivity towards electrophile is

\[
\text{C}_6\text{H}_5\text{OH} > \text{C}_6\text{H}_5\text{CH}_3 > \text{C}_6\text{H}_6 > \text{C}_6\text{H}_5\text{Cl}
\]

104. (d) \( \text{S}_\text{N}1 \) reaction is favoured by heavy groups on the carbon atom attached to halogen i.e Benzyl > allyl > tertiary > primary > secondary > primary > alkyl halides

\[
\text{CH}_2\text{Cl} \xrightarrow{\text{Cl}^-} \text{CH}_2
\]

Obtained from \( \text{S}_\text{N}1 \) path.

This molecule is resonance stabilised.

105. (d) More the number of alkyl groups, greater will be the dispersal of positive charge and therefore more the stability of carbocation.

\[
\text{CH}_3
\]

Thus \( \text{CH}_3 - \text{C}^+ \) is most stable

106. (c) Phenols are more acidic than alcohols as they are resonance stabilised whereas alcohols are not. Further \( \text{NO}_2 \) is an electron withdrawing group which increases acidic character and facilitates release of proton, whereas \( \text{CH}_3 \) is an electron donating group which decreases acidic character, thus removal of H\(^+\) becomes difficult.

107. (b) Among the given compounds naphthalene is volatile but benzoic acid is non-volatile (it forms a dimer). So, the
best method for their separation is sublimation, which is applicable to compounds which can be converted directly into the vapour phase from its solid state on heating and back to the solid state on cooling. Hence it is the most appropriate method.

108. (b) $\text{H}_2\text{C} = \text{C} = \text{CHCl} \rightarrow \text{H}_2\text{C} = \text{C} = \text{CHCl}^+$

109. (a) Amino group is ring activating while nitro group is deactivating. Hence, correct order is

\[ \text{I} > \text{II} > \text{III} \]

$\text{NO}_2$ is an electron attracting group hence decrease the electron density on ring, whereas $\text{NH}_2$ group is electron releasing group hence increase electron density on ring. Benzene is also $\text{e}^-$ rich due to delocalization of electrons.

110. (b) In the presence of UV rays or energy $\text{O}_2$ by boiling, free radical is generated which attack the methyl carbon atom of toluene.

111. (a) Electron releasing group ($\text{CH}_3$) decreases acidity while electron withdrawing group ($\text{NO}_2$) increases acidity.

112. (b) The principle of steam distillation is based on Dalton’s law of partial pressures. Suppose $p_1$ and $p_2$ be the vapour pressures of water vapour and the toluene at the distillation temperature.

Toluene boils when total pressure is equal to atmospheric pressure $p = p_1 + p_2$ or $p_2 = p - p_1$.

As a result when toluene boil in the presence of steam its partial pressure $p_2$ is less than atmospheric pressure.

113. (a) $\text{CH}_4$ and $\text{NH}_2$ and $\text{OH}$ are electron donating groups, whereas $\text{NO}_2$ is an electron withdrawing group and leaves the benzene ring deactivated. Due to stronger electron attracting (-I effect) effect of $\text{NO}_2$ group $\text{C}_6\text{H}_5\text{NO}_2$ shows least reactivity towards electrophilic substitution.

114. (a) Electron withdrawing group ($\text{-NO}_2$) increases the acidity while electron releasing group ($\text{-CH}_3, \text{-H}$) decreases acidity. Also effect will be more if functional group is present at para position then ortho and meta position.

115. (d) $\text{-Cl}$ atom shows $\text{o/p}$-directive influence but deactivate the benzene ring, while $\text{[-OH/-CH}_3\text{]}$ groups show $\text{o/p}$ influence and activate the benzene ring but $\text{-OH}$ group is more activating than $\text{-CH}_3$.

Hence order of electrophilic substitution

116. (c) The compound is diethyl ether ($\text{CH}_3\text{CH}_2\text{O}$) which is resistant to nucleophilic attack by hydroxyl ion due to absence of double or triple bond, whereas all other compounds given are unsaturated.

117. (c) The atom or group which has more power to attract electrons in comparision to hydrogen is said to have -I effect. Thus higher the electronegativity of atom stronger will be the -I effect. As electronegativity of N, O & F follow the order $\text{N} < \text{O} < \text{F}$ hence based upon electronegative character order of-I effect is $\text{NR}_2 < \text{-OR} < \text{-F}$.

118. (c) IR spectroscopy is used for the purification of cyclohexanone from a mixture of benzoic acid, isoamyl alcohol, cyclohexane and
cyclohexanone. Because in this method, each functional group appears at a certain peak. So, cyclohexanone can be identified by carbonyl peak.

119. (d) When (–) 2 bromooctane is allowed to react with sodium hydroxide under given conditions, where second order kinetics is followed, the product obtained is (+) 2-octanol.

120. (c) In arenes, π electrons are delocalised, hence arenes do not undergo addition reactions easily. Aromatic compounds (Arenes) are highly stable and show resonance eg. Benzene is the simplest example.

121. (d) –OCH₃ activates the benzene ring. –NO₂ deactivates the ring. Hence the reaction of the given compounds with electrophiles is in the order, I > II > III.

122. (c) More is the electron - deficiency of the carbonyl carbon, greater will be the reactivity of the carbonyl compounds towards nucleophilic addition.

123. (d) Such questions can be solved by considering the relative basic character of their conjugated bases which for H₂O, C₂H₆, H₂CO₃ and C₆H₅OH are

\[ \text{–OH, } \text{HO}^- < \text{HCO}_3^- < \text{C}_6\text{H}_5\text{O}^- \]

More the possibility for the dispersal of the negative charge, weaker will be the base. Thus the relative basic character of the four bases is

\[ \text{HCO}_3^- < \text{C}_6\text{H}_5\text{O}^- < \text{–OH} < \text{HC} \equiv \text{C}^- \]

Equivalent Non-equivalent Oxygen can accommodate resonating structures

Due to resonance

Thus the acidic character of the four corresponding acids will be

\[ \text{HC} \equiv \text{CH} < \text{H}_2\text{O} < \text{C}_6\text{H}_5\text{OH} < \text{H}_2\text{CO}_3 \]

124. (c) Chlorination of methane proceeds via free radical mechanism. Conversion of methyl chloride to methyl alcohol proceeds via nucleophilic substitution. Formation of ethylene from ethyl alcohol proceeds via dehydration reaction. Nitration of benzene is electrophilic substitution reaction.

125. (b) Hydrazine (NH₂NH₂) does not contain carbon and hence on fusion with Na metal, it cannot form NaCN; so it does not show Lassaigne’s test for nitrogen.

126. (d) The boiling point of o-nitrophenol is less than para-nitrophenol due to presence of intramolecular hydrogen bonding. Since p-nitrophenol is less volatile than o-nitrophenol due to presence of inter-molecular hydrogen bonding hence they can be separated by steam distillation.

127. (d) Carboxylic acids dissolve in NaHCO₃ and evolve CO₂ gas but phenols do not.

\[ \text{RCOOH} + \text{NaHCO}_3 \rightarrow \text{RCOONa} + \text{H}_2\text{O} + \text{CO}_2 \]

128. (d) Due to + I-effect of the CH₃ group, toluene has much higher electron density in the ring than benzene. Nitrobenzene and benzoic acid as nitro and carboxylic group show- I-effect and hence toluene is most reactive towards nitration.

129. (c) Higher the possibility of delocalisation of the positive charge, greater is stability of the species. Thus

\[ (\text{CH}_3)_3\text{C}^- > (\text{CH}_3)_2\text{C}^+ > \text{C}_6\text{H}_5\text{CH}_2\text{CH}_3^+ > \text{CH}_2\text{CH}_3^+ \]

Also, primary benzyl carbocation have almost the same stability as 2°-alkyl carbocations.

130. (b) Sodium cyanide (Na + C + N → NaCN).

(Lassaigne's test)

131. (a) Kjeldal’s method is suitable for estimating nitrogen in those compounds in which nitrogen is linked to carbon and hydrogen. The method is not used in case of nitro, azo and azoxy compound. This method is basically used for estimating nitrogen in food fertilizers and agricultural products.

132. (d) Nitrogen, sulphur and halogens are tested in an organic compound by Lassaigne’s test. The organic compound is fused with sodium metal as to convert these elements into ionisable inorganic substances,

\[ \text{Na} + \text{C} + \text{N} \rightarrow \text{NaCN} \]
\[ 2\text{Na} + \text{S} \rightarrow \text{Na}_2\text{S} \]
\[ 2\text{Na} + \text{X}_2 \rightarrow 2\text{NaX} \]

The cyanide, sulphide or halide ions can be confirmed in aqueous solution by usual test.