ORGANIC CHEMISTRY–SOME BASIC PRINCIPLES & TECHNIQUES

FACT/DEFINITION TYPE QUESTIONS

1. Which of the following scientist proposed that a 'vital force' was responsible for the formation of organic compounds ?

(a) Berzilius (b) Wohler
(c) Berthelot (d) Kolbe

2. First organic compound to be synthesised was

(a) methane (b) cane sugar
(c) acetic acid (d) urea

3. Which of the following organic compound was synthesised by F. Wohler from an inorganic compound?

(a) Methane (b) Urea
(c) Acetic acid (d) Chloroform

4. The discovery that shook the belief in the vital force theory was

(a) Stereoisomerism
(b) Synthesis of indigo
(c) Wholer's synthesis of urea from ammonium cyanate
(d) Fermentation of sugars

5. In laboratory, first organic compound was synthesised by

(a) Kekule (b) Hennel
(c) Wohler (d) Liebig

6. Who is known as the "Father of Chemistry"?

(a) Faraday (b) Priestley
(c) Rutherford (d) Lavoisier

7. The hybridisation of carbon atom in C — C single bond of $H_2C=CH—CH=CH_2$ is

(a) $sp^3 — sp$ (b) $sp^2 — sp$
(c) $sp^2 — sp^2$ (b) $sp^3 — sp^3$

8. In the hydrocarbon

$CH_3 - CH = CH - CH_2 - C \equiv CH$
6 5 4 3 2 1

The state of hybrization of carbons 1, 3 and 5 are in the following sequence

(a) sp^2, sp, sp^3 (b) sp, sp^3, sp^2
(c) sp, sp^2, sp^3 (d) sp^3, sp^2, sp

9. The percentage of s- character of the hybrid orbitals in ethane, ethene and ethyne are respectively.

(a) 50, 75, 100 (b) 10, 20, 40
(c) 25, 33, 50 (d) 25, 50, 75

10. Select the molecule which has only one π-bond

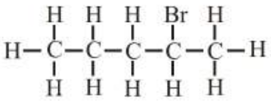
(a) $CH\equiv CH$ (b) $CH_2=CHCHO$
(c) $CH_3CH=CH_2$ (d) $CH_3CH=CHCOOH$

11. 2- Pentene contains

(a) 15 σ- and one π- bond (b) 14 σ-and one π- bond
(c) 15 σ- and two π- bonds (d) 14 σ- and two π- bonds

12. Which of the following does not represent the 2 – bromo pentane ?

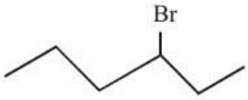
(i)



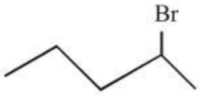
$$\mathrm{H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{Br}{C}}-\underset{H}{\overset{H}{C}}-H}$$

(ii)

(iii)



(iv)

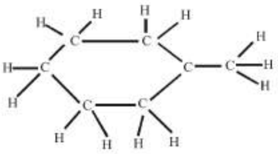


(v) $CH_3CH_2CH_2CHBrCH_3$

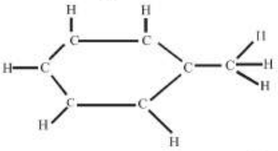
(a) (ii), (iii) and (v) (b) Only (ii)
(c) (ii) and (iii) (d) (iii) and (v)

13. Which of the following correctly represents the expanded form of following organic compound ?

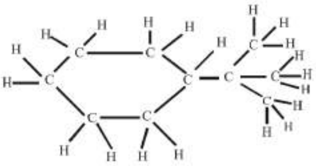
(a)



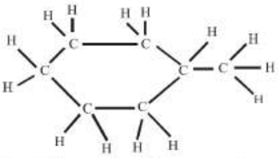
(b)



(c)

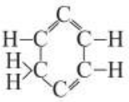


(d)

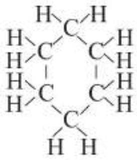


14. Structural formula of benzene is

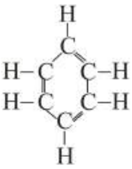
(a)



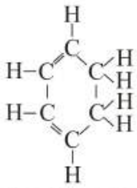
(b)



(c)



(d)



15. The successive members in a homologues series differ from each other by ________

(a) $-CH_2CH_2^-$ unit (b) $-CH_2$ unit

(c) $-OCH_3$ unit (d) $-CH_3$ unit

16. Which of the following have incorrect molecular formula?

A. Icosane – $C_{10}H_{22}$

B. Triacontane – $C_{30}H_{62}$

C. Nonane – C_9H_{20}

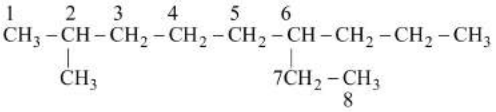
D. Heptane – C_7H_{14}

(a) (A) and (D) (b) Only (D)

(c) (B) and (D) (d) Only (B)

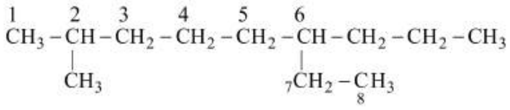
17. Which of the following are incorrect methods of selecting parent chain ?

(i)



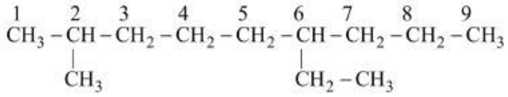
$$\overset{1}{CH_3}-\underset{\displaystyle CH_3}{\overset{2}{CH}}-\overset{3}{CH_2}-\overset{4}{CH_2}-\overset{5}{CH_2}-\underset{\displaystyle 7CH_2-\underset{8}{CH_3}}{\overset{6}{CH}}-CH_2-CH_2-CH_3$$

(ii)



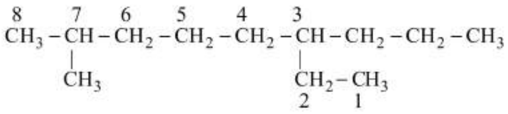
$$\overset{1}{CH_3}-\underset{\displaystyle CH_3}{\overset{2}{CH}}-\overset{3}{CH_2}-\overset{4}{CH_2}-\overset{5}{CH_2}-\underset{\displaystyle {}_7CH_2-\underset{8}{CH_3}}{\overset{6}{CH}}-CH_2-CH_2-CH_3$$

(iii)



$$\overset{1}{CH_3}-\underset{\displaystyle CH_3}{\overset{2}{CH}}-\overset{3}{CH_2}-\overset{4}{CH_2}-\overset{5}{CH_2}-\underset{\displaystyle CH_2-CH_3}{\overset{6}{CH}}-\overset{7}{CH_2}-\overset{8}{CH_2}-\overset{9}{CH_3}$$

(iv)



$$\overset{8}{CH_3}-\underset{\displaystyle CH_3}{\overset{7}{CH}}-\overset{6}{CH_2}-\overset{5}{CH_2}-\overset{4}{CH_2}-\underset{\displaystyle \underset{2}{CH_2}-\underset{1}{CH_3}}{\overset{3}{CH}}-CH_2-CH_2-CH_3$$

(a) (i) and (ii) (b) (iv) only

(c) (i), (ii) and (iv) (d) (ii) only

18. The correct decreasing order of priority of functional groups is

(a) $-SO_3H$, $-OH$, $-COCl$, $>C=C<$

(b) $-COOH$, $-SO_3H$, $-COOR$, $-OH$

(c) $-C\equiv C$, $-NH_2$, $-OH$, $>C=O$

(d) $-CN$, $-CONH_2$, $>C=O$, $-OH$

19. Which of the following is incorrectly matched –

(a) vinegar → carboxylic acid

(b) $C_2H_6 \rightarrow$ alkane

(c) ethanol → alcohol

(d) methanol → ketone

20. The functional group present in organic, acid is –

(a) $-OH$ (b) $-CHO$

(c) $-COOH$ (d) $>C=O$

21. Which of these contains the carbonyl group?

(a) ketones (b) aldehydes

(c) esters (d) all of these

22. Butanone is a four-carbon compound with the functional group –

(a) carboxylic acid (b) aldehyde.

(c) ketone (d) alcohol.

23. The functional group present in $CH_3COOC_2H_5$ is –

(a) ketonic (b) aldehydic

(c) ester (d) carboxylic

24. Which of the following compounds contains 1°, 2°, 3° as well as 4° carbon atoms ?

(a) Neopentane (b) 2-methyl pentane

(c) 2,3-dimethyl butane (d) 2,2,3-trimethyl pentane

25. The number of secondary hydrogens in 2, 2-dimethylbutane is

(a) 8 (b) 6

(c) 4 (d) 2

26. The compound which has one isopropyl group is

(a) 2, 2, 3, 3 - Tetramethylpentane

(b) 2, 2 - Dimethylpentane

(c) 2, 2, 3- Trimethylpentane

(d) 2- Methypentane

27. Which of the following statements is false for isopentane ?

(a) It has three CH_3 groups

(b) It has one CH_2 group

(c) It has one CH group

(d) It has a carbon which is not bonded to hydrogen

28. The number of primary, secondary and tertiary carbons in 3, 4-dimethylheptane are respectively

(a) 4, 3 and 2 (b) 2, 3 and 4
(c) 4, 2 and 3 (d) 3, 4 and 2

29. The number of primary, secondary, tertiary and quaternary carbons in neopentane are respectively

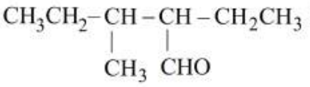
(a) 4, 3, 2 and 1 (b) 5, 0, 0 and 1
(c) 4, 0, 0 and 1 (d) 4, 0, 1 and 1

30. What is the IUPAC name of t-butyl alcohol.

(a) Butanol–2 (b) 2–Methyl–propan–2-ol
(c) Butanol–1 (d) Propanol–2

31. The IUPAC name of $CH_3COCH(CH_3)_2$ is -

(a) isopropyl methyl ketone
(b) 2-methyl-3-butanone
(c) 4-methylisopropyl ketone
(d) 3-methyl-2-butanone

32. 
$CH_3CH_2-\underset{CH_3}{\underset{|}{CH}}-\underset{CHO}{\underset{|}{CH}}-CH_2CH_3$ has the IUPAC name –

(a) 2–sec butylbutanal
(b) 2, 3–diethylbutanal
(c) 2–ethyl–3–methylpentanal
(d) 3–methyl–2–ethylpentanal

33. Which of the following statements is false for isopentane–

(a) It has three CH_3 groups
(b) It has one CH_2 group
(c) It has one CH group
(d) It has a carbon which is not bonded to hydrogen

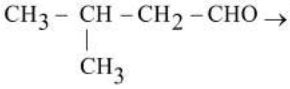
34. The IUPAC name of the compound

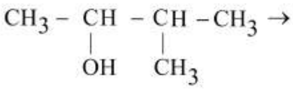
$CH_3OCH_2CH_2CH_2OCH_2CH_3$ is

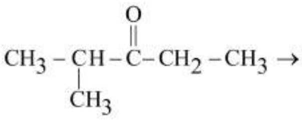
(a) 3-ethoxy-1-methoxypropane
(b) 1-ethoxy-3-methoxypropane
(c) 2, 5-dioxyhexane
(d) ethoxypropane oxymethane

35. Which of the following compounds has wrong IUPAC name?

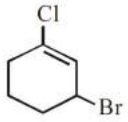
(a) $CH_3-CH_2-CH_2-COO-CH_2CH_3 \rightarrow$ ethyl butanoate

(b) 
$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CHO \rightarrow$ 3-methyl-butanal

(c) 
$CH_3-\underset{OH}{\underset{|}{CH}}-\underset{CH_3}{\underset{|}{CH}}-CH_3 \rightarrow$ 2-methyl-3-butanol

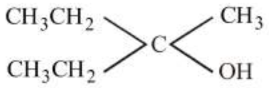
(d) 
$CH_3-\underset{CH_3}{\underset{|}{CH}}-\overset{O}{\overset{||}{C}}-CH_2-CH_3 \rightarrow$ 2-methyl-3-pentanone

36. The IUPAC name of the compound shown below is



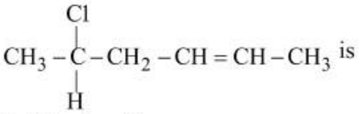
(a) 3-bromo-1-chlorocyclohexene
(b) 1-bromo-3-chlorocyclohexene
(c) 2-bromo-6-chlorocyclohex-1-ene
(d) 6-bromo-2-chlorocyclohexene

37. Name of the following compound is



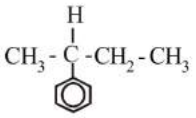
(a) 2-ethylbutan-2-ol
(b) 1-ethyl-1-methylpropan-1-ol
(c) 3-methyl pentan-3-ol
(d) diethylethanol

38. The IUPAC name for


$CH_3-\underset{H}{\underset{|}{\overset{Cl}{\overset{|}{C}}}}-CH_2-CH=CH-CH_3$ is

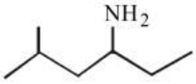
(a) 5–chlorohex–2–ene
(b) 2–chlorohex–5–ene
(c) 1–chloro–1–methylpent–3–ene
(d) 5–chloro–5–methylpent–2–ene

39. IUPAC name of following compound is :



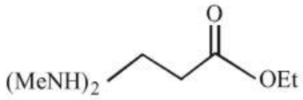
(a) 2 - cyclohexylbutane (b) 2 - phenylbutane
(c) 3 - cyclohexylbutane (d) 3 - phenylbutane

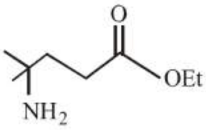
40. What is the IUPAC name of the following compound ?

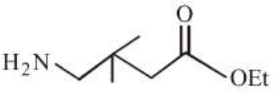


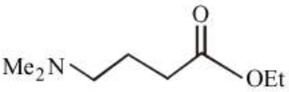
(a) 2-methyl-4-hexanamine
(b) 5-methyl-3-hexanamine
(c) 2-methyl-4-amino hexane
(d) 5-methyl-3-amino hexane

41. Which one of the following is ethyl-4-(dimethyl amino) butanoate ?

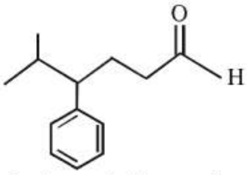
(a) 

(b) 

(c) 

(d) 

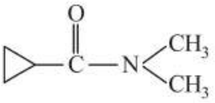
42. Identify the correct IUPAC name of the compound given below



(a) 4 – benzyl – 5 – methyl hexanal
(b) 2 – methyl – 3 – phenyl hexanal
(c) 5 – isopropyl – 5 – phenyl butanal
(d) 5 – methyl – 4 – phenyl hexanal

43. IUPAC name of $(CH_3)_3CCl$ is
(a) 1-butyl chloride
(b) 3-chloro butane
(c) 2-chloro-2-methylpropane
(d) 2-butyl chloride

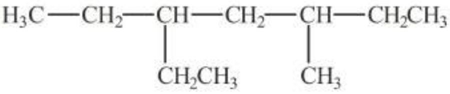
44. IUPAC name of the following compound



(a) N, N-dimethylcyclopropane carboxamide
(b) N-methylcyclopropanamide'
(c) cyclopropionamide
(d) None of these

45. Which of the following is a 3-methylbutyl group?
(a) $CH_3CH_2CH_2CH_2CH_2-$
(b) $(CH_3CH_2)_2CH-$
(c) $(CH_3)_3CCH_2-$
(d) $(CH_3)_2CHCH_2CH_2-$

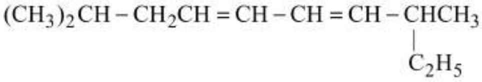
46. The IUPAC name of the following compound



$$H_3C-CH_2-\underset{\substack{|\\ CH_2CH_3}}{CH}-CH_2-\underset{\substack{|\\ CH_3}}{CH}-CH_2CH_3$$

is
(a) 3-ethyl-5-methylheptane
(b) 5-ethyl-3-methylheptane
(c) 3,5-diethylhexane
(d) 1,1-diethyl-3-methylpentane

47. The IUPAC name of the following compound is



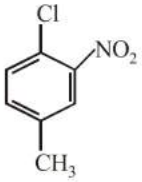
$$(CH_3)_2CH-CH_2CH=CH-CH=CH-\underset{\substack{|\\ C_2H_5}}{CH}CH_3$$

(a) 1,1,7,7-tetramethyl-2,5-octadiene
(b) 2,8-dimethyl-3,6-decadiene
(c) 1,5-di-iso-propyl-1,4-hexadiene
(d) 2,8-dimethyl-4,6-decadiene

48. The IUPAC name of the compound $CH_3-CH(CH_3)-CO-CH_3$, is
(a) 3-methyl 2-butanone
(b) 2-methyl 3-butanone
(c) isopropyl methyl ketone
(d) methyl isopropyl ketone

49. The IUPAC name of neopentane is
(a) 2, 2-dimethylpropane (b) 2-methylpropane
(c) 2, 2-dimethylbutane (d) 2-methylbutane

50. The IUPAC name for



(a) 1-Chloro-2-nitro-4-methyl benzene
(b) 1-Chloro-4-methyl-2-nitrobenzene
(c) 2-Chloro-1-nitro-5-methyl benzene
(d) *m*-Nitro-*p*-chlorotoluene

51. What is the IUPAC name of the following compound ?

(a) 6 – bromo – 4 – ethylbenzene carboxylic acid
(b) 2 – bromo – 4 – ethylbenzene carboxylic acid
(c) Ortho – bromo – paraethyl benzoic acid
(d) 4 – bromo – 3 – ethyl benzoic acid

52. Total number of structural isomers possible for C_3H_6 are :
(a) 2 (b) 1
(c) 4 (d) 3

53. An aromatic compound of formula C_7H_7Cl has in all ..... isomers :
(a) 5 (d) 2
(c) 4 (d) 3

54. CH_3CH_2OH and CH_3OCH_3 are the examples of
(a) chain isomerism (b) functional isomerism
(c) position isomerism (d) metamerism

55. Which organic structure among the following is not an isomer of the compound $CH_3-CO-CH_2CH_2CH_2CH_3$?
(a) $CH_3CH_2OCH=CHCH_2CH_3$
(b) $CH_3CH=CHCH_2CH_2CHO$
(c) $(CH_3)_2CH-CO-CH_2CH_3$
(d) $CH_3CH_2COCH_2CH_2CH_3$

56. The least number of carbon atoms in alkane showing isomerism is
(a) 3 (b) 1
(c) 2 (d) 4

57. The number of possible alkynes with molecular formula C_5H_8 is
(a) 2 (b) 3
(c) 4 (d) 5

58. The total number of isomers for C_4H_8 is
(a) 5 (b) 6
(c) 7 (d) 8

59. Which of the following compounds is isomeric with 2, 2, 4, 4- tetramethylhexane?
(a) 3-ethyl -2, 2- dimethylpentane
(b) 4-isopropylheptane
(c) 4-ethyl-3-methyl-4-n propyloctane
(d) 4, 4-diethyl-3-methylheptane

60. Which are isomers ?
(a) ethyl alcohol and dimethyl ether
(b) acetone and acetaldehyde
(c) propionic acid and propanone
(d) methyl alcohol and dimethyl ether

61. Methoxyethane and propanol are the examples of isomerism of the type
(a) structural (b) position
(c) functional (d) tautomerism

62. Isomers of propionic acid are
(a) $HCOOC_2H_5$ and CH_3COOCH_3
(b) $HCOOC_2H_5$ and C_3H_7COOH
(c) CH_3COOCH_3 and C_3H_7OH
(d) C_3H_7OH and CH_3COCH_3

63. $C_6H_5C\equiv N$ and $C_6H_5N \overset{-}{\equiv} C$ are which type of isomers?
(a) Position (b) Functional
(c) Tautomerism (d) Linkage

64. A functional isomer of 1-butyne is
(a) 2-butyne (b) 1-butene
(c) 2-butene (d) 1, 3-butadiene

65. In which of the following, functional group isomerism is not possible?
(a) Alcohols (b) Aldehydes
(c) Alkyl halides (d) Cyanides

66. The compounds $CH_3CH{=}CHCH_3$ and $CH_3CH_2CH{=}CH_2$
(a) are tautomers
(b) are position isomers
(c) contain same number of sp^3-sp^3, sp^3-sp^2 and sp^2-sp^2 carbon-carbon bonds
(d) exist together in dynamic equilibrium

67. Heterolytic fission of a covalent bond in organic molecules gives
(a) free radicals (b) cations and anions
(c) only cations (d) only anions

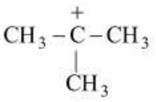
68. Which of the following statements is not correct ?
(a) Carbocation posses sextet of electrons.
(b) The order of carbocation stability is :

$$\overset{+}{C}H_3 > (CH_3)_2\overset{+}{C}H > (CH_3)_3\overset{+}{C}$$

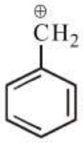
(c) Carbocations have trigonal planar shape
(d) Carbocations are formed by heterolytic cleavage

69. Heterolytic fission of C – Br bond results in the formation of
(a) free radical (b) carbanion
(c) carbocation (d) Both (b) and (c)

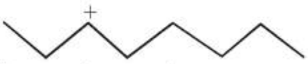
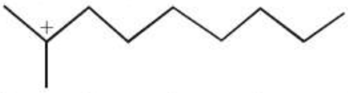
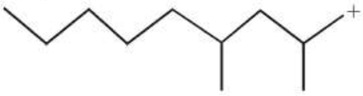
70. Which of the following carbocations is least stable?
(a) *tert*-Alkyl (b) *sec*-Alkyl
(c) *pri*-Alkyl (d) Methyl

71. Which of the following ions is most stable ?
(a) 
$CH_3-\overset{+}{C}(CH_3)-CH_3$
(b) $CH_3CH_2\overset{+}{C}H_2$
(c) $CH_3\overset{+}{C}HCH_2CH_3$ (d) None of these

72. The order of stability of the following carbocations :

$CH_2=CH-\overset{\oplus}{C}H_2$; CH_3 CH_2 $\overset{\oplus}{C}H_2$;  is :
I II III

(a) III > II > I (b) II > III > I
(c) I > II > III (d) III > I > II

73. Select the most stable carbocation amongst the following
(a) 
(b) 
(c) 
(d) 

74. What is the correct order of decreasing stability of the following cations.

I. $CH_3-\overset{\oplus}{C}H-CH_3$

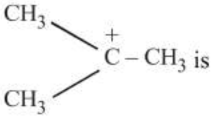
II. $CH_3-\overset{\oplus}{C}H-OCH_3$

III. $CH_3-\overset{\oplus}{C}H-CH_2-OCH_3$

(a) II > I > III (b) II > III > I
(c) III > I > II (d) I > II > III

75. The most stable carbonium ion among the following is
(a) $C_6H_5\overset{+}{C}HC_6H_5$ (b) $C_6H_5\overset{+}{C}H_2$
(c) $CH_3\overset{+}{C}H_2$ (d) $C_6H_5CH_2\overset{+}{C}H_2$

76. The organic reaction which proceed through heterolytic bond cleavage are called ________
(a) ionic (b) polar
(c) nonpolar (d) Both (a) and (b)

77. Among the following, the true property about

$(CH_3)_2\overset{+}{C}-CH_3$ is
(a) it is non-planar
(b) its C^+ is sp^2-hybridized
(c) an electrophile can attack on its C^+
(d) it does not undergo hydrolysis

78. The shape of methyl carbanion is similar to that of –
(a) BF_3 (b) NH_3
(c) methyl free radical (d) methyl carbocation

79. Arrange the carbanions,

$(CH_3)_3\bar{C}, \bar{C}Cl_3, (CH_3)_2\bar{C}H, C_6H_5\bar{C}H_2$

in order of their decreasing stability :

(a) $(CH_3)_2\bar{C}H > \bar{C}Cl_3 > C_6H_5\bar{C}H_2 > (CH_3)_3\bar{C}$

(b) $\bar{C}Cl_3 > C_6H_5\bar{C}H_2 > (CH_3)_2\bar{C}H > (CH_3)_3\bar{C}$

(c) $(CH_3)_3\bar{C} > (CH_3)_2\bar{C}H > C_6H_5\bar{C}H_2 > \bar{C}Cl_3$

(d) $C_6H_5\bar{C}H_2 > \bar{C}Cl_3 > (CH_3)_3\bar{C} > (CH_3)_2\bar{C}H$

80. The homolytic fission of a covalent bond liberates
(a) Carbonium ions (b) Carbanions
(c) Free radicals (d) Carbenes

81. Homolytic fission of C–C bond in ethane gives an intermediate in which carbon is
(a) sp^3-hybridised (b) sp^2-hybridised
(c) sp-hybridised (d) sp^2d-hybridised

82. Geometry of methyl free-radical is
(a) pyramidal (b) planar
(c) tetrahedral (d) linear

83. In which of the following homolytic bond fission takes place ?
(a) Alkaline hydrolysis of ethyl chloride
(b) Addition of HBr to double bond
(c) Photochlorination of methane
(d) Nitration of benzene

84. On exciting, Cl_2 molecules by UV light, we get
(a) $Cl^{\bullet}$ (b) Cl^+
(c) Cl^- (d) all of these

85. The increasing order of stability of the following free radicals is
(a) $(C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C} < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
(b) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$
(c) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$
(d) $(C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$

86. Which of the following orders regarding relative stability of free radicals is correct?
(a) $3° < 2° < 1°$ (b) $3° > 2° > 1°$
(c) $1° < 2° > 3°$ (d) $3° > 2° < 1°$

87. The most stable free radical among the following is
(a) $C_6H_5CH_2\dot{C}H_2$ (b) $C_6H_5\dot{C}HCH_3$
(c) $CH_3\dot{C}H_2$ (d) $CH_3\dot{C}HCH_3$

88. For the reaction of phenol with $CHCl_3$ in presence of KOH, the electrophile is
(a) $^+CHCl_2$ (b) $:CCl_2$
(c) $\dot{C}HCl_2$ (d) CCl_4

89. The least stable free radical is
(a) $CH_3\dot{C}H_2$ (b) $CH_3CH_2\dot{C}H_2$
(c) $(CH_3)_2\dot{C}H$ (d) $\dot{C}H_3$

90. Which of the following is strongest nucleophile
(a) Br^- (b) $:OH^-$
(c) $:CN^-$ (d) $C_2H_5\bar{O}:$

91. Which of the following represents a set of nucleophiles?
(a) BF_3, H_2O, NH_2^- (b) $AlCl_3, BF_3, NH_3$
(c) CN^-, RCH_2^-, ROH (d) All of these

92. Which of the following species does not acts as a nucleophile?
(a) ROH (b) ROR
(c) PCl_3 (d) BF_3

93. Which of the following is an electrophile ?
(a) Lewis acid
(b) Lewis base
(c) Negatively charged species
(d) None of the above

94. Which of the following pairs represent electrophiles?
(a) $AlCl_3, H_2O$ (b) SO_3, NO_2^+
(c) BF_3, H_2O (d) NH_3, SO_3

95. Which out of A, B, C and D is/are not correctly categorised.

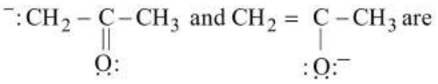
	Nucleophile	Electrophile
A.	HS^-	Cl^+
B.	BF_3	$(CH_3)_3N$
C.	H_2N^-	$-\overset{+}{C}=O$
D.	R_3C-X $(X = \text{Halogen})$	$C_2H_5O^-$

(a) B, C and D (b) C and D
(c) C only (d) B and D

96. Arrangement of $(CH_3)_3-C-, (CH_3)_2-CH-, CH_3-CH_2-$ when attached to benzyl or an unsaturated group in increasing order of inductive effect is
(a) $(CH_3)_3-C- < (CH_3)_2-CH- < CH_3-CH_2^-$
(b) $CH_3-CH_2- < (CH_3)_2-CH- < (CH_3)_3-C-$
(c) $(CH_3)_2-CH- < (CH_3)_3-C- < CH_3-CH_2-$
(d) $(CH_3)_3-C- < CH_3-CH_2- < (CH_3)_2-CH-$

97. Polarization of electrons in acrolein may be written as
(a) $\overset{\delta-}{CH_2} = CH - \overset{\delta+}{CH} = O$ (b) $\overset{\delta-}{CH_2} = CH - CH = \overset{\delta+}{O}$
(c) $\overset{\delta-}{CH_2} = \overset{\delta-}{CH} - CH = O$ (d) $\overset{\delta+}{CH_2} = CH - CH = \overset{\delta-}{O}$

98. Point out the incorrect statement about resonance?
(a) Resonance structures should have equal energy
(b) In resonating structures, the constituent atoms must be in the same position
(c) In resonating structures, there should not be same number of electron pairs
(d) Resonating structures should differ only in the location of electrons around the constituent atoms

99. 
$^-:CH_2-\underset{\underset{\ddot{O}:}{\|}}{C}-CH_3$ and $CH_2=\underset{\underset{:\ddot{O}:^-}{|}}{C}-CH_3$ are
(a) resonating structures (b) tautomers
(c) geometrical isomers (d) optical isomers

100. In which of the following, resonance will be possible?

(a) $CH_3-CH_2-CH_2-CHO$

(b) $CH_2=CH-CH=O$

(c) CH_3COCH_3

(d) $CH_2=CH-CH_2-CH=CH_2$

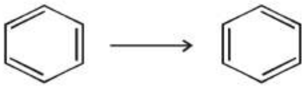
101. Which of the following statements regarding the resonance energy of benzene is *correct*?

(a) Resonance energy is the energy required to break the C–H bond in benzene

(b) Resonance energy is the energy required to break the C–C bond in benzene

(c) Resonance energy is a measure of stability of benzene

(d) Resonance energy is the energy required to convert



102. Which of the following is not correctly matched ?

	Group showing + R effect	**Group showing – R effect**
(a)	$-NHCOR$	$-COOH$
(b)	$>C=O$	$-OH$
(c)	$-OR$	$-CHO$
(d)	$-OCOR$	$-NO_2$

103. The polarity is 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.

The above statement is true for which of the following ?

(a) Inductive effect (b) Electromeric effect

(c) Resonance effect (d) Hyperconjugation

104. Electromeric effect is a

(a) permanent effect (b) temporary effect

(c) resonance effect (d) inductive effect

105. The kind of delocalization involving sigma bond orbitals is called

(a) inductive effect (b) hyperconjugation effect

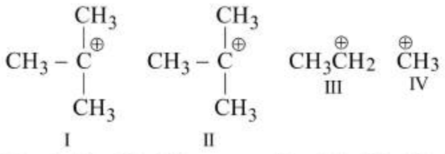
(c) electromeric effect (d) mesomeric effect

106. Hyperconjugation involves overlap of the following orbitals

(a) σ-σ (b) $\sigma-\pi$

(c) p- p (d) π-π

107. Choose the correct order of stability of carbocation using concept of hyperconjugation.



$CH_3-\overset{\oplus}{C}(CH_3)_2$ (I), $CH_3-\overset{\oplus}{C}H(CH_3)$...

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

(c) III < IV < II < I (d) None of these

108. Hyperconjugation is most useful for stabilizing which of the following carbocations ?

(a) neo-Pentyl (b) tert-Butyl

(c) iso-Propyl (d) Ethyl

109. Which of the following is an example of elimination reaction?

(a) Chlorination of methane

(b) Dehydration of ethanol

(c) Nitration of benzene

(d) Hydroxylation of ethylene

110. $CH_3-Br+NH_3 \rightarrow CH_3-NH_2+HBr$

The above reaction is classified as

(a) substitution (b) addition

(c) elimination (d) rearrangement

111. Which of the following method is not used for determining purity of a compound ?

(a) Chromatographic techniques

(b) Spectroscopic techniques

(c) Melting point

(d) All of the above parameters are used for determining the purity of a compound.

112. Which of the following is not the criteria of purity of a substance?

(a) solubility (b) melting point

(c) boiling point (d) density

113. In crystallisation process impurities which impart colour to the solution are removed by which of the following ?

(a) Repeated crystallisation

(b) Activated charcoal

(c) Bleaching agent

(d) Both (a) and (b)

114. Aniline is purified by

(a) steam distillation (b) simple distillation

(c) vacuum distillation (d) extraction with a solvent

115. Which is purified by steam distillation

(a) Aniline (b) Benzoic acid

(c) Petroleum (d) Naphthalene

116. The best method for the separation of naphthalene and benzoic acid from their mixture is:

(a) distillation (b) sublimation

(c) chromatography (d) crystallisation

117. In steam distillation the vapour pressure of volatile organic compound is

(a) equal to atmospheric pressure

(b) double the atmospheric pressure

(c) less than atmospheric pressure

(d) more than atmospheric pressure

118. Fractional distillation is used when

(a) there is a large difference in the boiling point of liquids

(b) there is a small difference in the boiling points of liquids

(c) boiling points of liquids are same

(d) liquids form a constant boiling mixture

119. Purification of petroleum is carried out by

(a) fractional distillation (b) steam distillation

(c) vacuum distillation (d) simple distillation

120. A liquid decomposes at its boiling point. It can be purified by

(a) steam distillation (b) fractional distillation

(c) vacuum distillation (d) sublimation

121. Distillation under reduced pressure is employed for

(a) C_6H_6

(b) petrol

(c) $CH_2OHCHOHCH_2OH$

(d) organic compounds used in medicine

122. Impure glycerine is purified by

(a) steam distillation (b) simple distillation

(c) vacuum distillation (d) None of these

123. Glycerol can be separated from spent lye in soap industry by which of the following method ?

(a) Steam distillation

(b) Fractional distillation

(c) Distillation under reduced pressure

(d) Differential extraction

124. The latest technique for the purification of organic compounds is

(a) chromatography (b) fractional distillation

(c) crystallization (d) vacuum distillation

125. Which of the following is used as an adsorbent in adsorption chromatography ?

(a) Silica gel (b) Alumina

(c) Zeolite (d) Both (a) and (b)

126. Which of the following acts as the stationary phase in paper chromatography ?

(a) Water (b) Alumina

(c) Silica gel (d) None of these

127. The most satisfactory method to separate mixture of sugars is

(a) fractional crystallisation (b) sublimation

(c) chromatography (d) benedict reagent

128. Chromatography is a valuable method for the separation, isolation, purification and identification of the constituents of a mixture and it is based on general principle of

(a) phase rule (b) phase distribution

(c) interphase separation (d) phase operation

129. In paper chromatography

(a) moving phase is liquid and stationary phase in solid

(b) moving phase is liquid and stationary phase is liquid

(c) moving phase is solid and stationary phase is solid

(d) moving phase is solid and stationary phase is liquid

130. Which of the following is used for detection of carbon and hydrogen ?

(a) $Ca(OH)_2$ (b) CuO

(c) $CaCl_2$ (d) KOH

131. In sodium fusion test of organic compounds, the nitrogen of the organic compound is converted into

(a) sodamide (b) sodium cyanide

(c) sodium nitrite (d) sodium nitrate

132. Which of the following compounds does not show Lassaigne's test for nitrogen ?

(a) Urea (b) Hydrazine

(c) Phenylhydrazine (d) Azobenzene

133. The compound formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is

(a) $Fe_4[Fe(CN)_6]_3$ (b) $Na_3[Fe(CN)_6]$

(c) $Fe(CN)_3$ (d) $Na_4[Fe(CN)_5NOS]$

134. In quantitative analysis of carbon and hydrogen, the mass of water produced is determined by passing the mixture through a weighed U – tube containing ____X____ and carbon dioxide is absorbed in concentrated solution of ____Y____

(a) $X = CaCl_2$, $Y = NaOH$

(b) $X = Ca(OH)_2$, $Y = CuSO_4$

(c) $X = CuSO_4$, $Y = Ca(OH)_2$

(d) $X = CaCl_2$, $Y = KOH$

135. Kjeldahl method is not applicable to which of the following ?

(a) Nitro compounds (b) Azo compounds

(c) Pyridine (d) All of these.

136. Nitrogen in an organic compound can be estimated by

(a) Kjeldahl's method only(b) Duma's method only

(c) Both (a) and (b) (d) Neither (a) nor (b)

137. Duma's method involves the determination of nitrogen content in the organic compound in form of

(a) NH_3 (b) N_2

(c) NaCN (d) $(NH_4)_2SO_4$

138. In Kjeldahl's method nitrogen present is estimated as

(a) N_2 (b) NH_3

(c) NO_2 (d) None of these

139. In kjeldahl's method of estimation of nitrogen, K_2SO_4 acts as

(a) oxidising agent (b) catalytic agent

(c) hydrolysing agent (d) boiling point elevator

140. 0.5g of an organic compound containing nitrogen on Kjeldahlising required 29 mL of N/5 H_2SO_4 for complete neutralization of ammonia. The percentage of nitrogen in the compound is

(a) 34.3 (b) 16.2

(c) 21.6 (d) 14.8

141. The percentage of sulphur in an organic compound whose 0.32 g produces 0.233 g of $BaSO_4$ [At. wt. Ba = 137, S = 32] is

(a) 1.0 (b) 10.0

(c) 23.5 (d) 32.1

142. An organic compound contains C = 40%, H = 13.33% and N = 46.67%. Its empirical formula would be

(a) CHN (b) C_2H_2N

(c) CH_4N (d) C_3H_7N

143. 2.79 g of an organic compound when heated in Carius tube with conc. HNO_3 and H_3PO_4 formed converted into $MgNH_4.PO_4$ ppt. The ppt. on heating gave 1.332 g of $Mg_2P_2O_7$. The percentage of P in the compound is

(a) 23.33% (b) 13.33%

(c) 33.33% (d) 26.66%

144. A compound contains 38.8% C, 16% H and 45.2% N. The formula of compound would be :

(a) CH_3NH_2 (b) CH_3CN

(c) C_2H_5CN (d) $CH_2(NH_2)_2$

145. In estimation of percentage of oxygen. The mixture of gaseous products containing oxygen is passed over red hot coke. All oxygen is converted to __A__. This mixture is passed through __B__ when __A__ is converted to __C__ .

What is A, B and C in above statement.

(a) $A = CO_2$, $B = KOH$, $C =$ pure O_2

(b) $A = CO$, $B = I_2O_5$, $C = CO_2$

(c) $A = CO$, $B = I_2$, $C = CO_2$

(d) $A = CO_2$, $B = Ca(OH)_2$, $C = CaCO_3$

STATEMENT TYPE QUESTIONS

146. Which of the following statement(s) is/are correct ?

(i) A carbon atom having an *sp* hybrid orbital is less electronegative than carbon atoms possessing sp^2 or sp^3 hybridised orbitals.

(ii) π-bonds provide the most reactive centres in the molecules containing multiple bonds

(iii) The number of σ and π bonds in compound $CH_2{=}C{=}CHCH_3$ are 7 and 2 respectively.

(a) (i) and (iii) (b) (ii) and (iii)

(c) (ii) only (d) (i) only

147. Which of the following sequence of T and F is correct. Here T stands for true statement and F stands for false statement

(i) In heterolytic cleavage the bond breaks in such a fashion that the shared pair of electrons remain with one of the fragment.

(ii) In homolytic cleavage, one of the electrons of the shared pair in a covalent bond goes with each of the bonded atoms.

(iii) $R-X \xrightarrow[\text{light}]{\text{heat or}} \dot{R} + \dot{X}$

This equation represents heterolytic cleavage

(a) TTF (b) FFT

(c) FFF (d) TTT

148. Which of the following is/are correct for inductive effect ?

(i) In inductive effect polarisation of sigma bond is caused by the adjacent σ bond.

(ii) Halogens, $-NO_2$, $-CN$, and $-CH_3$ are electron withdrawing groups.

(iii) $-CH_2CH_3$ and $-OC_6H_5$ are electron donating groups.

(a) (i) only (b) (ii) only

(c) (i) and (iii) (d) (i), (ii) and (iii)

149. Which of the following sequence of T and F is correct for given statements. Here T stands for correct and F stands for false statement

(i) The more the number of contributing structures, the more is the resonance energy.

(ii) The resonance structures have different positions of nuclei but same number of unpaired electrons

(iii) The energy of actual structure of the molecule (the resonance hybrid) is lower than that of any of the canonical structures.

(a) TTT (b) TFT

(c) FFF (d) TFF

150. Which of the following statements are correct for fractional distillation ?

(i) Fractional distillation method is used if the two liquids have sufficiently large difference in their boiling points.

(ii) A fractionating column provides many surfaces for heat exchange between the ascending vapours and the descending condensed liquid.

(iii) Each successive condensation and vaporisation unit in the fractionating column is called a theoretical plate.

(iv) Fractional distillation method is used to separate different fractions of crude oil in petroleum industry.

(a) (i), (ii) and (iv) (b) (ii), (iii) and (iv)

(c) (i), (ii) and (iii) (d) (i), (ii), (iii) and (iv)

151. Which of the following sequence of T and F is currect for given statements. Here 'T' stands for True and 'F' stands for False statement.

(i) The relative adsorption of each component of mixture is expressed in terms of its retardation factor (R_F)

(ii) Retardation factor is given as :

$$R_F = \frac{\text{Distance moved by the solvent from base line}}{\text{Distance moved by the substance from base line}}$$

(iii) In TLC the spots of colourless compounds can be detected by ultraviolet light.

(iv) Spots of amino acids may be detected by iodine.

(a) TTFF (b) TFFF

(c) TTTT (d) TFTF

152. In Kjeldahl's method for the estimation of N_2 , potassium sulphate and copper sulphate are used. On the basis of their functions which of the following statement(s) is/are correct?

(i) Potassium sulphate raises the bpt. and ensures complete reaction.

(ii) Copper sulphate acts as catalyst.

(iii) Potassium sulphate acts as catalyst and copper sulphate raises the bpt.

(a) Only (iii) is correct (b) (i) and (ii) are correct

(c) Only (ii) is correct (d) None is correct

153. In the estimation of carbon and hydrogen by combustion method which of the following is/are correct ?

(i) A spiral of copper is introduced at the right extreme of combustion tube if the organic compound contains nitrogen.

(ii) A spiral of silver is introduced if the organic compound contains halogens.

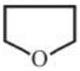
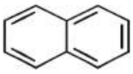
(iii) The copper oxide in the combustion tube is replaced by lead chromate if the organic compound contains sulphur.

(a) (i) and (ii) are correct (b) (i) and (iii) are correct

(c) (ii) and (iii) are correct (d) All are correct

MATCHING TYPE QUESTIONS

154. Match the columns

	Column-I		**Column-II**
(A)	Non – benzenoid compound	(p)	
(B)	Alicyclic compound	(q)	
(C)	Benzenoid compound	(r)	
(D)	Heterocyclic aromatic compound	(s)	

(a) A – (r), B – (p), C – (s), D – (q)
(b) A – (s), B – (p), C – (q), D – (r)
(c) A – (p), B – (r), C – (s), D – (q)
(d) A – (r), B – (p), C – (q), D – (s)

155. Match Column-I (organic compound) with Column-II (common name of the compound) and choose the correct option.

	Column-I (Organic compound)		**Column-II (Common name of compound)**
(A)	$C_6H_5OCH_3$	(p)	Neopentane
(B)	$H_3CCH_2CH_2OH$	(q)	Anisole
(C)	$(H_3C)_4C$	(r)	Acetophenone
(D)	$C_6H_5COCH_3$	(s)	n – propyl alcohol.

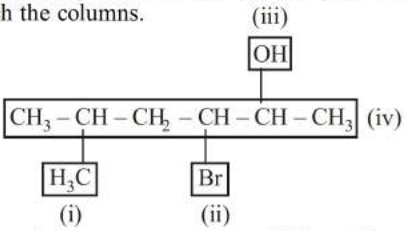
(a) A – (r), B – (s), C – (p), D – (q)
(b) A – (r), B – (p), C – (s), D – (q)
(c) A – (q), B – (s), C – (p), D – (r)
(d) A – (q), B – (s), C – (r), D – (p)

156. Match the columns

	Column-I		**Column-II**
(A)	Aldehyde	(p)	Chloro
(B)	Ketone	(q)	ol
(C)	Alcohol	(r)	one
(D)	Halogen	(s)	al

(a) A – (s), B – (r), C – (q), D – (p)
(b) A – (s), B – (q), C – (p), D – (r)
(c) A – (p), B – (q), C – (r), D – (s)
(d) A – (r), B – (s), C – (q), D – (p)

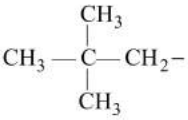
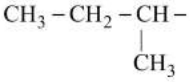
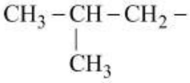
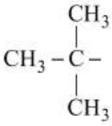
157. Identify (i), (ii), (iii) and (iv) in the structure of given organic compound. On the basis of your identification match the columns.



Column-I			**Column-II**
A	(i)	(p)	Functional group
B	(ii)	(q)	Branch chain
C	(iii)	(r)	Parent chain
D	(iv)	(s)	Homologues unit

(b) A – (p), B – (s), C – (q), D – (r)
(c) A – (q), B – (p), C – (p), D – (r)
(d) A – (q), B – (p), C – (q), D – (r)

158. Match the columns.

	Column-I		**Column–II**
(A)	 $CH_3-\underset{\underset{CH_3}{\mid}}{\overset{\overset{CH_3}{\mid}}{C}}-CH_2-$	(p)	Isobutyl
(B)	 $CH_3-CH_2-\underset{\underset{CH_3}{\mid}}{CH}-$	(q)	sec – Butyl
(C)	 $CH_3-\underset{\underset{CH_3}{\mid}}{CH}-CH_2-$	(r)	Neopentyl
(D)	 $CH_3-\underset{\underset{CH_3}{\mid}}{\overset{\overset{CH_3}{\mid}}{C}}-$	(s)	tert – Butyl

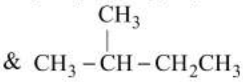
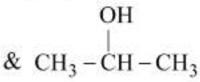
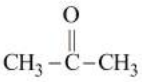
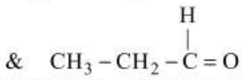
(a) A – (r), B – (q), C – (p), D –(s)
(b) A – (s), B – (p), C – (r), D –(q)
(c) A – (s), B – (p), C – (q), D –(r)
(d) A – (s), B – (q), C – (p), D –(r)

159. Column-II give formula for compounds given in Column-I, match them correctly.

	Column-I		**Column-II**
(A)	Propane	(p)	C_2H_5OH
(B)	ethyl alcohol	(q)	C_3H_8
(C)	carboxylic acid	(r)	CH_3COOH
(D)	ethyl ethanoate	(s)	$CH_3COOC_2H_5$

(a) A – (q), B – (p), C – (r), D – (s)
(b) A – (p), B – (q), C – (s), D – (r)
(c) A – (q), B – (s), C – (p), D – (r)
(d) A – (q), B – (p), C – (s), D – (r)

160. Match the columns

	Column-I (Organic compounds)		**Column-II (Type of isomerism)**
(A)	$CH_3CH_2CH_2CH_2CH_3$  & $CH_3-\overset{\overset{CH_3}{\mid}}{CH}-CH_2CH_3$	(p)	Functional group isomerism
(B)	$CH_3CH_2CH_2OH$  & $CH_3-\overset{\overset{OH}{\mid}}{CH}-CH_3$	(q)	Chain isomerism
(C)	 $CH_3-\overset{\overset{O}{\parallel}}{C}-CH_3$  & $CH_3-CH_2-\overset{\overset{H}{\mid}}{C}=O$	(r)	Metamerism
(D)	$CH_3OC_3H_7$ & $C_2H_5OC_2H_5$	(s)	Position isomerism

(a) A – (s), B – (q), C – (r), D – (p)
(b) A – (s), B – (q), C – (p), D – (r)
(c) A – (q), B – (s), C – (r), D – (p)
(d) A – (q), B – (s), C – (p), D – (r)

161. Match the columns

	Column-I		Column-II
(A)	CH_3COOH & $HCOOCH_3$	(p)	Functional isomers
(B)	1 butene & 2-butene	(q)	Metamers
(C)	diethyl ether & methyl propyl ether	(r)	Position isomers
(D)	dimethyl ether and ethanol	(s)	Chain isomers and ethanol

(a) A – (p), B – (r), C – (q), D – (s)
(b) A – (q), B – (r), C – (s), D – (p)
(c) A – (q), B – (s), C – (p), D – (r)
(d) A – (q), B – (p), C – (s), D – (r)

162. Match the columns

	Column-I		Column-II
(A)	Free radical	(p)	Trigonal planar
(B)	Carbocation	(q	Pyramidal
(C)	Carbanion	(r)	Linear

(a) A – (p), B – (q), C – (r)
(b) A – (p), B – (p), C – (q)
(c) A – (r), B – (p), C – (q)
(d) A – (p), B – (p), C – (r)

163. Match the columns

	Column - I		Column - II
(A)	Separation of sublimable compounds from non sublimable	(p)	Steam distillation
(B)	Method based on the difference in the solubilities of the compound and the impurities in a suitable solvent	(q)	Sublimation
(C)	Separation of liquids having sufficient difference in their boiling points.	(r)	Distillation
(D)	Separation of substances which are steam volatile and are immiscible with water.	(s)	Crystallisation

(a) A – (q), B – (s), C – (r), D – (p)
(b) A – (q), B – (r), C – (p), D – (s)
(c) A – (s), B – (q), C – (r), D – (p)
(d) A – (q), B – (s), C – (p), D – (r)

164. Match the columns

	Column - I (Elements)		Column - II (Colour of precipitate formed in Lassaigne's test)
(A)	Nitrogen	(p)	Yellow
(B)	Sulphur	(q)	Prussian blue
(C)	Chlorine	(r)	Violet
(D)	Phosphorus	(s)	White

(a) A – (q), B – (r), C – (p), D – (s)
(b) A – (r), B – (q), C – (p), D – (s)
(c) A – (q), B – (r), C – (s), D – (p)
(d) A – (r), B – (q), C – (s), D – (p)

165. Match the columns

	Column - I		Column - II
(A)	Duma's method	(p)	$\frac{80 \times m_1 \times 100}{188 \times m}$
(B)	Kjeldahl's method	(q)	$\frac{31 \times m_1 \times 100}{1877 \times m}\%$
(C)	Carius method for bromine	(r)	$\frac{1.4 \times M \times 2\left(v - \frac{v_1}{2}\right)}{m}\%$
(D)	Percentage of phosphorus	(s)	$\frac{28 \times V \times 100}{22400 \times m}\%$

(a) A – (s), B – (r), C – (p), D – (q)
(b) A – (r), B – (s), C – (q), D – (p)
(c) A – (s), B – (p), C – (q), D – (r)
(d) A – (p), B – (r), C – (q), D – (s)

ASSERTION-REASON TYPE QUESTIONS

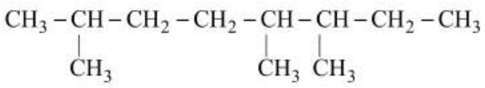
Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
(c) Assertion is correct, reason is incorrect
(d) Assertion is incorrect, reason is correct.

166. Assertion : A primary suffix indicates the type of linkage in the carbon atom.
Reason : CN is a Primary suffix

167. Assertion : The general formula for a dihydric alcohol is $C_nH_{2n}(OH)_2$
Reason : Ethylene glycol is a dihydric alcohol.

168. Assertion : IUPAC name of the following organic compound is 3, 4, 7 – trimethyloctane



$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_3$$

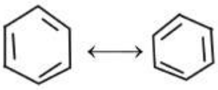
Reason : The numbering is done in such a way that the branched carbon atoms get the lowest possible numbers.

169. Assertion : Chain isomerism is observed in compounds containining four or more than four carbon atoms
Reason : Only alkanes show chain isomerism

170. Assertion : But-1-ene and 2-methylprop-1-ene are position isomers.
Reason : Position isomers have same molecular formula but differ in position of functional group or C = C.

171. Assertion : Benzene exhibit two different bond lengths, due to C – C single and C = C double bonds.

Reason : Actual structure of benzene is a hybrid of following two structures.



172. Assertion : Aniline is better nucleophile than anilium ion.

Reason : Anilium ion have +ve charge.

173. Assertion : Different number of electron pairs are present in resonance structures.

Reason : Resonance structures differ in the location of electrons around the constituent atoms.

174. Assertion : Energy of resonance hybrid is equal to the average of energies of all canonical forms.

Reason : Resonance hybrid cannot be presented by a single structure.

175. Assertion : Simple distillation can help in separating a mixture of propan-1-ol (boiling point 97°C) and propanone (boiling point 56°C).

Reason : Liquids with a difference of more thatn 20°C in their boiling points can be separated by simple distillation.

176. Assertion : Components of a mixture of red and blue inks can be separated by distributing the components between stationary and mobile phases in paper chromatography.

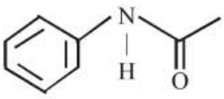
Reason : The coloured components of inks migrate at different rates because paper selectively retains different components according to the difference in their partition between the two phases.

177. Assertion : Sulphur present in an organic compound can be estimated quantitatively by Carius method.

Reason : Sulphur is separated easily from other atoms in the molecule and gets precipitated as light yellow solid.

CRITICAL THINKING TYPE QUESTIONS

178. The IUPAC name of the following compounds is



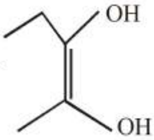
(a) N – phenyl ethanamide

(b) N – phenyl ethanone

(c) N – phenyl methanamide

(d) None of these

179 IUPAC name of



is :

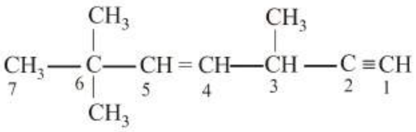
(a) But – 2 ene – 2, 3 – diol

(b) Pent – 2 –ene – 2, 3 – diol

(c) 2 – methylbut – 2 – ene – 2, 3 – diol

(d) Hex – 2 – ene – 2, 3 – diol

180. The state of hybridization of C_2, C_3, C_5 and C_6 of the hydrocarbon,



$$\underset{7}{CH_3}-\underset{6}{\overset{CH_3}{\underset{CH_3}{C}}}-\underset{5}{CH}=\underset{4}{CH}-\underset{3}{\overset{CH_3}{CH}}-\underset{2}{C}\equiv\underset{1}{CH}$$

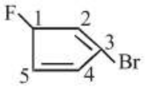
is in the following sequence

(a) sp^3, sp^2, sp^2 and sp (b) sp, sp^2, sp^2 and sp^3

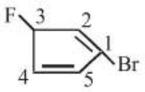
(c) sp, sp^2, sp^3 and sp^2 (d) sp, sp^3, sp^2 and sp^3

181. Which of the following numberings is correct ?

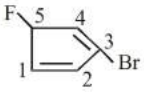
A.



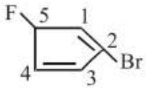
B.



C.



D.



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

182. The ratio of π- to σ- bonds in benzene is

(a) 1 : 4 (b) 1 : 2

(c) 3 : 1 (d) 1 : 6

183. In which of the compounds given below there is more than one kind of hybridization (sp, sp^2, sp^3) for carbon ?

(i) $CH_3CH_2CH_2CH_3$ (ii) $CH_3CH=CHCH_3$

(iii) $CH_2=CH-CH=CH_2$ (iv) $H-C\equiv C-H$

(a) (ii) (b) (iii) and (iv)

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

184. Which of the following represents the given mode of hybridisation sp^2–sp^2 – sp – sp from left to right?

(a) $H_2C=CH-C\equiv N$ (b) $CH\equiv C-C\equiv CH$

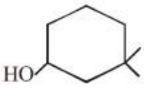
(c) $H_2C=C=C=CH_2$ (d)

185. The compound in which $\overset{x}{C}$ uses its sp^3 - hybrid orbitals for bond formation is

(a) $\overset{X}{H}COOH$ (b) $(H_2N)_2\overset{X}{C}O$

(c) $(CH_3)_3\overset{X}{C}OH$ (d) $CH_3\overset{X}{C}HO$

186. The IUPAC name of the compound is



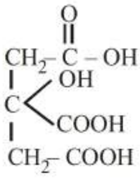
(a) 3, 3-dimethyl - 1- cyclohexanol

(b) 1, 1-dimethyl-3-hydroxy cyclohexane

(c) 3, 3-dimethyl-1-hydroxy cyclohexane

(d) 1, 1-dimethyl-3-cyclohexanol

187. The IUPAC name of compound



$$\begin{array}{l} CH_2-\overset{\overset{O}{\|}}{C}-OH \\ | \\ C\begin{cases} OH \\ COOH \end{cases} \\ | \\ CH_2-COOH \end{array}$$

is:

(a) 1, 2, 3 - tricarboxy - 2, 1 - propane

(b) 3 - carboxy - 3 hydroxy - 1 , 5 - pentanedioic acid

(c) 3 - hydroxy - 3 - carboxy - 1, 5 - pentanedioic acid

(d) 2 - hydroxy propane -1, 2, 3 - tricarboxylic acid.

188. The number of possible open chain (acyclic) isomeric compounds for molecular formula C_5H_{10} would be

(a) 8 (b) 7

(c) 6 (d) 5

189. Which of the following compounds will show metamerism?

(a) $CH_3-CO-C_2H_5$ (b) $C_2H_5-S-C_2H_5$

(c) CH_3-O-CH_3 (d) $CH_3-O-C_2H_5$

190. The compound $C_4H_{10}O$ can show

(a) metamerism (b) functional isomerism

(c) position isomerism (d) All of these

191. Which pair of isomerism is not possible together?

(a) Ring-chain and functional

(b) Geometrical and optical

(c) Metamerism and functional

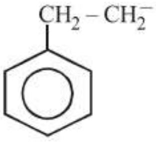
(d) Metamerism and chain

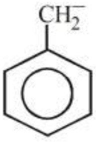
192. Which of the following represents the correct order of stability of the given carbocations ?

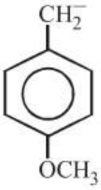
(a) $F_3\overset{+}{C} > F_3C-\underset{|}{\overset{|}{C}}{}^{+} > \overset{+}{C}H_3$ (b) $H_3\overset{+}{C} > F_3C-\underset{|}{\overset{|}{C}}{}^{+} > F_3\overset{+}{C}$

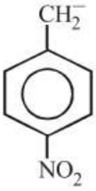
(c) $F_3C-\underset{|}{\overset{|}{C}}{}^{+} > F_3\overset{+}{C} > H_3\overset{+}{C}$ (d) $F_3C-\underset{|}{\overset{|}{C}}{}^{+} > H_3\overset{+}{C} > F_3\overset{+}{C}$

193. The most stable carbanion among the following is

(a)


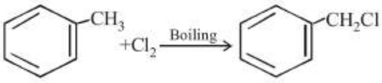
(b)


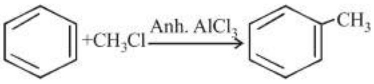
(c)


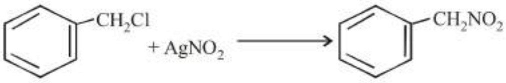
(d)


194. Which one of the following is a free-radical substitution reaction?

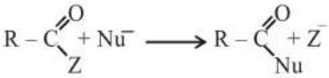
(a) $CH_3CHO + HCN \longrightarrow CH_3CH(OH)CN$

(b)


(c)


(d)


195. Rate of the reaction



$$R-\overset{\overset{O}{\|}}{\underset{Z}{C}} + Nu^- \longrightarrow R-\overset{\overset{O}{\|}}{\underset{Nu}{C}} + Z^-$$

is fastest when Z is

(a) OC_2H_5 (b) NH_2

(c) Cl (d) $OCOCH_3$

196. 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) $I^- < Br^- < Cl^-$

197. Which of the following is least reactive in a nucleophilic substitution reaction.

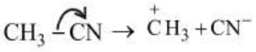
(a) $(CH_3)_3C-Cl$

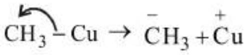
(b) $CH_2=CHCl$

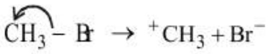
(c) CH_3CH_2Cl

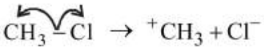
(d) $CH_2=CHCH_2Cl$

198. Which of the following does not represent formation of reactive intermediate correctly ?

(i)

$CH_3-CN \rightarrow \overset{+}{C}H_3 + CN^-$

(ii)

$CH_3-Cu \rightarrow \overset{-}{C}H_3 + \overset{+}{C}u$

(iii)

$CH_3-Br \rightarrow {}^+CH_3 + Br^-$

(iv)

$CH_3-Cl \rightarrow {}^+CH_3 + Cl^-$

(a) (ii) only (b) (ii) and (iii)

(c) (ii) and (iv) (d) (iii) and (iv)

199. In Lassaigne's test, the organic compound is fused with a piece of sodium metal in order to

(a) increase the ionisation of the compound

(b) decrease the melting point of the compound

(c) increase the reactivity of the compound

(d) convert the covalent compound into a mixture of ionic compounds

200. The most suitable method for separtion of a 1 : 1 mixture of ortho and para nitrophenols is

(a) Sublimation (b) Chromatography

(c) Crystallization (d) Steam distillation

201. The Lassaigne's extract is boiled with dil. HNO_3 before testing for halogens because

(a) silver halides are soluble in HNO_3

(b) Na_2S and NaCN are decomposed by HNO_3

(c) Ag_2S is soluble in HNO_3

(d) AgCN is soluble is HNO_3

202. The molecular mass of an organic compound which contains only one nitrogen atom can be

(a) 152 (b) 146

(c) 76 (d) 73

203. 0.25 g of an organic compound on Kjeldahl's analysis gave enough ammonia to just neutralize $10cm^3$ of 0.5 M H_2SO_4. The percentage of nitrogen in the compound is

(a) 28 (b) 56

(c) 14 (d) 112

204. During hearing of a court case, the judge suspected that some changes in the documents had been carried out. He asked the forensic department to check the ink used at two different places. According to you which technique can give the best results?

(a) Column chromatography

(b) Solvent extraction

(c) Distillation

(d) Thin layer chromatography

HINTS AND SOLUTIONS

FACT/DEFINITION TYPE QUESTIONS

1. **(a)** Berzilius, a Swedish chemist proposed the concept of 'vital force'.

2. **(d)** Urea was first discovered in human urine by H.M. Rouelle in 1773. It was synthesised in 1828 by Friedrich Wohler and was the first organic compound to be synthesised from inorganic starting materials. It was found when Wohler attempted to synthesize ammonium cyanate, to continue a study of cyanates which he had be carrying out for several years. On treating silver cyanate with ammonium chloride solution he obtained a white crystalline material which proved identical to urea obtained from urine.

3. **(b)** F. Wohler synthesised urea from an inorganic compound ammonium cyanate

$$\underset{\text{Ammonium cyanate}}{NH_4CNO} \xrightarrow{\text{Heat}} \underset{\text{Urea}}{NH_2CONH_2}$$

4. **(c)** According to vital force theory, organic compounds could only be produced by living matter by a vital force. It was in 1828, Friedrich Wholer heated NH_4CNO (derived from inorganic substance) and obtained urea (an organic compound).

5. **(c)** Wholer synthesized urea from ammonium cyanate in 1828. Kekule proposed catenation and structure of benzene. Liebig is a history maker in sports science (energy metabolism).

6. **(d)** Antoine-Laurent de Lavoisier (August 26, 1743 – May 8, 1794) is known as the "*father of modern chemistry*." He was a French nobleman prominent in the histories of chemistry, finance, biology, and economics. He stated the first version of the Law of conservation of mass, co-discovered, recognized and named oxygen (1778) as well as hydrogen, disproved the phlogiston theory, introduced the *Metric system*, invented the first periodic table including 33 elements, and helped to reform chemical nomenclature.

7. **(c)** Hybridisation on the particular carbon can be established by number of σ and π bonds attached to it.

σ Bond	π Bond	Hybridisation
4	–	sp^3
3	1	sp^2
2	2	sp

$$\overset{1}{C}H_2 = \overset{2}{C}H - \overset{3}{C}H = \overset{4}{C}H_2$$

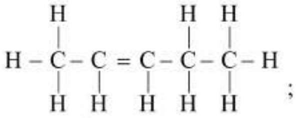
3σ	3σ	3σ	3σ
1π	1π	1π	1π
∴ sp^2	sp^2	sp^2	sp^2

∴ Both carbon atoms forming C—C single bond (C_2 and C_3) are sp^2 hybridised

8. **(b)** C – 1 is sp hybridized $(C \equiv C)$
C – 3 is sp^3 hybridized (C– C)
C – 5 is sp^2 hybridized (C = C)
Thus the correct sequence is sp, sp^3, sp^2.

9. **(c)** **10.** **(c)**

11. **(b)**



2 – Pentene

No. of σ bonds = 14, No. of π bonds = 1

12. **(c)** (ii) and (iii) do not represent 2-bromopentane

13. **(c)** Correct expanded form of given structure is shown in option (c).

14. **(c)**

15. **(b)** The successive members of a homologous series differ by a $-CH_2$ unit.

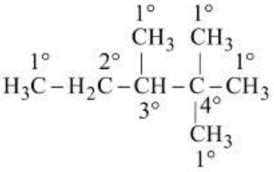
16. **(a)** Correct molecular formula of icosane is $C_{20}H_{42}$
Correct molecular formula of heptane is C_7H_{16}

17. **(c)** (iii) is the only correct method of selecting parent chain.

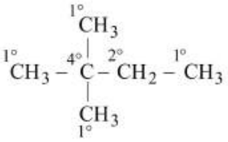
18. **(b)** Correct order of decreasing priority is
$-COOH$, $-SO_3H$, $-COOR$, $-OH$.

19. **(d)** **20.** **(c)** **21.** **(d)** **22.** **(c)** **23.** **(c)**

24. **(d)** 2, 2,3-trimethyl pentane

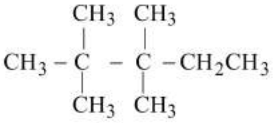


25. **(d)**

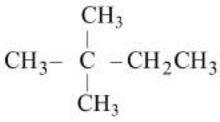


Thus number of secondary hydrogens is two.

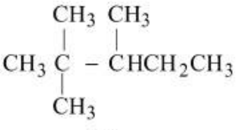
26. **(d)**



(a)

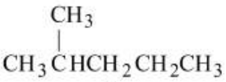


(b)



$$\mathrm{CH_3\overset{CH_3}{\underset{CH_3}{C}}-\overset{CH_3}{C}HCH_2CH_3}$$

(c)

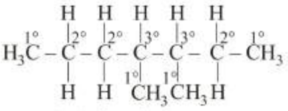


$$\mathrm{CH_3\overset{CH_3}{C}HCH_2CH_2CH_3}$$

(d)

27. **(d)** In isopentane, $(CH_3)_2CH\ CH_2\ CH_3$, every carbon is having hydrogen atom(s).

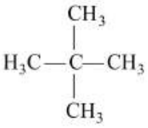
28. **(a)**



3, 4-dimethylheptane

There are four 1° C-atoms, three 2° C-atoms and two 3° C-atoms

29. **(c)** The structure of neopentane is



$$\mathrm{H_3C-\overset{CH_3}{\underset{CH_3}{C}}-CH_3}$$

It has 1 quaternary and 4 primary carbons.

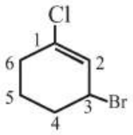
30. **(b)** **31.** **(d)** **32.** **(c)** **33.** **(d)**

34. **(a)** $$\mathrm{CH_3-O-\overset{1}{CH_2}-\overset{2}{CH_2}-\overset{3}{CH_2}-O-CH_2CH_3}$$

3-ethoxy-1-methoxypropane

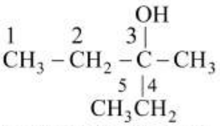
35. **(c)** The correct name is 3 - methylbutan - 2 - ol

36. **(a)**



3-bromo-1chlorocyclohexene

37. **(c)**



$$\mathrm{\overset{1}{CH_3}-\overset{2}{CH_2}-\overset{OH}{\underset{\overset{5}{CH_3}\overset{4}{CH_2}}{\overset{3}{C}}}-CH_3}$$

3 – Methyl pentan – 3 – ol

38. **(a)** The IUPAC name of the given compound is 5-chlorohex-2-ene.

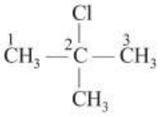
39. **(b)** The compound is a derivative of butane.

40. **(b)** The compound contains longest chain of 6C atoms and amino group. Hence it is an alkanamine.

41. **(d)** The compound is an ester. Its IUPAC name is derived from alkyl alkanoate.

42. **(d)** The compound is an aldehyde containing longest chain of 6 C-atoms and side chains.

43. **(c)**



$$\mathrm{\overset{1}{CH_3}-\overset{Cl}{\underset{CH_3}{\overset{2}{C}}}-\overset{3}{CH_3}}$$

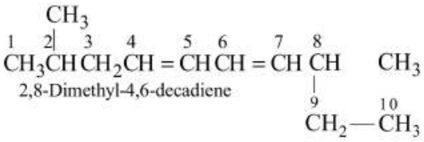
2-chloro-2-methyl propane

44. **(a)**

45. **(d)** $(CH_3)_2CHCH_2CH_2-$
3-methylbutyl group

46. **(a)**

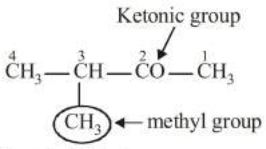
47. **(d)**



$$\mathrm{\overset{1}{CH_3}\overset{2}{\underset{}{\overset{CH_3}{C}}}H\overset{3}{CH_2}\overset{4}{CH}=\overset{5}{CH}\overset{6}{CH}=\overset{7}{CH}\overset{8}{\underset{\overset{9}{CH_2}-\overset{10}{CH_3}}{CH}}\quad CH_3}$$

2,8-Dimethyl-4,6-decadiene

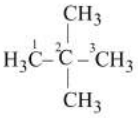
48. **(a)**



$$\mathrm{\overset{4}{CH_3}-\underset{CH_3}{\overset{3}{CH}}-\overset{2}{CO}-\overset{1}{CH_3}}$$

3-methyl-2-butanone

49. **(a)**



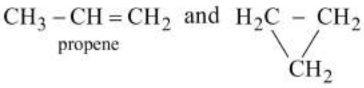
$$\mathrm{H_3\overset{1}{C}-\overset{CH_3}{\underset{CH_3}{\overset{2}{C}}}-\overset{3}{CH_3}}$$

Neopentane
or 2, 2- Dimethylpropane

50. **(b)**

51. **(b)** The compound is a derivative of benzoic acid. The positions of substituents attached to benzene nucleus are represented by number of C-atoms and not by ortho, meta and para.

52. **(a)** C_3H_6 has 2 structural isomers.

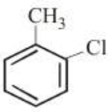


$CH_3-CH=CH_2$ and H_2C-CH_2 (with CH_2 below)

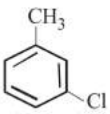
propene

cyclopropane

53. **(c)** C_7H_7Cl has 4 isomers

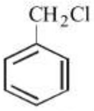


o-Chlorotoluene



m-Chlorotoluene

p-Chlorotoluene



benzyl chloride

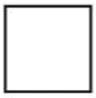
54. **(b)** Alcohols and ethers are functional isomers.

55. **(b)** Structures (*a*), (*c*) and (*d*) have the same molecular formula ($C_6H_{12}O$) while (*b*) has $C_6H_{10}O$ as molecular formula

56. **(d)**

57. **(b)** $\underset{\text{I}}{CH_3CH_2CH_2C{\equiv}CH}, \underset{\text{II}}{(CH_3)_2CHC{\equiv}CH}, \underset{\text{III}}{CH_3CH_2C{\equiv}CCH_3}$

58. **(b)** $\underset{\text{1-butene }(i)}{CH_3CH_2CH{=}CH_2}$ $\underset{\text{2- butene }(ii),\,(iii)\ (cis,\text{- }trans)}{CH_3CH{=}CHCH_3}$ $\underset{\text{2-methylpropene }(iv)}{(CH_3)_2C{=}CH_2}$



cyclobutane (*v*)

methylcyclopropane (*vi*)

59. **(b)** 2, 2, 4, 4 - Tetramethylhexane has 10 carbon atoms, only 4-isopropylheptane has also 10 carbon atoms so these two are isomers.

60. **(a)** **61.** **(c)** **62.** **(a)** **63.** **(b)** **64.** **(d)**

65. **(c)**

66. **(b)** The two isomers differ in the position of the double bond so they are called position isomers.

67. **(b)**

68. **(b)** The order of stability of carbocations is :

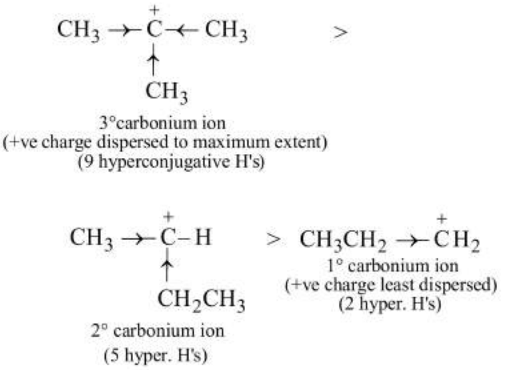
$$(CH_3)_3\overset{+}{C} > (CH_3)_2\overset{+}{C}H > \overset{+}{C}H_3$$

69. **(c)**

70. **(d)** Greater the number of alkyl groups attached to a positively charged C atom, greater is the hyperconjugation (no bond resonance) and stable is the cation.

Thus order of decreasing stability of carbocation is, tert – Alkyl > Sec-Alky > Pri-Alkyl > Methyl.

71. **(a)** Carbonium ions are electron deficient species. More the number of alkyl groups attached to it, more will be stability due to + I effect.



$$CH_3 \rightarrowtail \overset{+}{\underset{\underset{CH_3}{\uparrow}}{C}} \leftarrowtail CH_3 >$$

3°carbonium ion
(+ve charge dispersed to maximum extent)
(9 hyperconjugative H's)

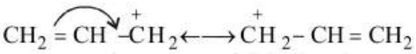
$$CH_3 \rightarrowtail \overset{+}{\underset{\underset{CH_2CH_3}{\uparrow}}{C}}-H > CH_3CH_2 \rightarrowtail \overset{+}{C}H_2$$

2° carbonium ion
(5 hyper. H's)

1° carbonium ion
(+ve charge least dispersed)
(2 hyper. H's)

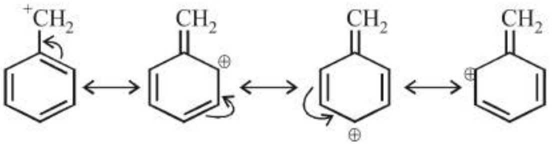
Alternatively, above order of stability order can be explained in terms of hyperconjugation.

72. **(d)** Higher stability of allyl and aryl substituted methyl carbocation is due to dispersal of positive charge due to resonance



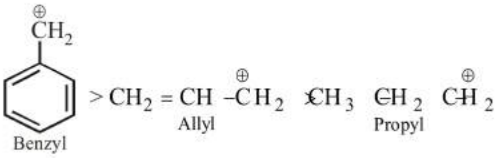
$$CH_2 = CH - \overset{+}{C}H_2 \longleftrightarrow \overset{+}{C}H_2 - CH = CH_2$$

Resonating structures of allyl carbocation



Resonating structures of benzyl carbocation

whereas in alkyl carbocations dispersal of positive charge on different hydrogen atoms is due to hyper conjugation hence the correct order of stability will be



73. **(b)** Structure (*b*) is a 3° carbocation, while (*a*) is 2° and (*c*) and (*d*) are 1° carbocations; thus (*b*) is the most stable.

74. **(a)**

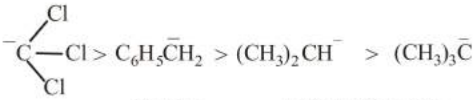
75. **(a)** Higher the possibility of delocalisation, greater is its stability; in $C_6H_5\overset{+}{C}HC_6H_5$, +ve charge can delocalise over two benzene rings.

76. **(d)** The organic reaction which proceed through heterolytic bond cleavage are called ionic or heteropolar or just polar reactions.

77. **(b)** In carbocations, carbon bearing positive charge is always sp^2-hybridised

78. **(b)** Methyl carbanion is sp^3 hybridised, with three bond pairs and one lone pair same is the case with NH_3.

79. **(b)**



$$^{-}CCl_3 > C_6H_5\bar{C}H_2 > (CH_3)_2CH^{-} > (CH_3)_3\bar{C}$$

–ve charge highly dispersed due to – I effect

–M effect delocalises –ve charge

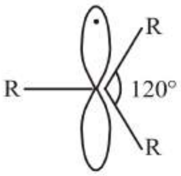
+I effect of CH_3 group intensifies the –ve charge

80. **(c)** In homolytic fission each of the atoms acquires one of the bonding electrons producing free radicals (species having one unpaired electron).

$$A \overset{\bullet\bullet}{-} B \longrightarrow A\bullet + \bullet B$$

81. **(b)** Homolytic fission of the C – C bond gives free radicals in which carbon is sp^2- hybridised.

82. **(b)** The carbon atom of alkyl free radicals which is bonded to only three atoms or groups of atoms is sp^2-hybridized. Thus free radicals have a planar structure with odd electrons situated in the unused *p*-orbital at right angles to the plane of hybrid orbitals.



83. **(c)**

84. **(a)** On exposure to UV light, Cl_2 molecule undergoes homolytic fission, to form chlorine free radicals.

$$Cl - Cl \xrightarrow{\text{U.V.}} \underset{\text{(Chlorine free radicals)}}{2Cl^{\cdot}}$$

85. **(b)** The order of stability of free radicals

$$(C_6H_5)_3\dot{C} > (C_6H_5)_2\dot{C}H > (CH_3)_3\dot{C} > (CH_3)_2\dot{C}H$$

The stabilisation of first two is due to resonance and last two is due to inductive effect.

86. **(d)** Free radicals are stabilized by hyperconjugation, thus 3° free radicals having maximum number of hyperconjugative structures are the most stable, and primary free radical the least.

87. **(b)** $C_6H_5\dot{C}HCH_3$ is a 2° benzylic free radical, hence stabilized most due to resonance.

88. **(b)** Dichlorocarbene, $:CCl_2$ (a carbene) is the electrophile formed as an intermediate in Reimer-Tiemann reaction.

89. **(d)** Order of stability of free radicals is

$$3° > 2° > 1° > \dot{C}H_3$$

90. **(c)** The strength of nucleophile depends upon the nature of alkyl group R on which nucleophile has to attack and also on the nature of solvent. The order of strength of nucleophiles follows the order :

$$CN^- > I^- > C_6H_5O^- > OH^- > Br^- > Cl^-$$

91. **(c)** **92.** **(d)**

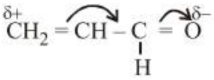
93. **(a)** Electrophile is positivly charged or electron deficient species. Lewis acids are electron acceptors that is electron deficient species.

94. **(b)** Electrophiles are electron deficient or positively charged species.

95. **(d)** BF_3 and $R_3C - X$ are electrophile while $(CH_3)_3N$ and $C_2H_5O^-$ are nucleophile

96. **(b)** $-CH_3$ group has +I effect, as number of $-CH_3$ group increases, the inductive effect increases.

97. **(d)** Due to – I effect of the – CHO group, oxygen acquires- δ - charge and the terminal carbon acquires δ + charge.



$$\overset{\delta+}{C}H_2 = CH - \underset{\underset{H}{|}}{C} = \overset{\delta-}{O}$$

98. **(c)** All resonating structures should have same number of electron pairs.

99. **(a)** The two structures involve only movement of electrons and not of atoms or groups, hence these are resonating structures.

100. **(b)** Only structure (*b*) has a conjugated system, which is necessary for resonance.

101. **(c)**

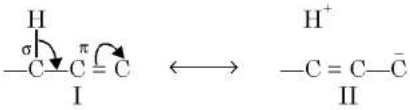
102. **(b)** – OH shows + R effect while $\rangle C = O$ shows – R effect.

103. **(c)** Resonance effect is the polarity produced in the molecule by the interactions of two π – bonds or between a π – bond and a lone pair of electrons present on an adjacent atom.

104. **(b)** Electromeric effect is purely a temporary effect and is brought into play only at the requirement of attacking reagent, it vanishes out as soon as the attacking reagent is removed from reaction mixture.

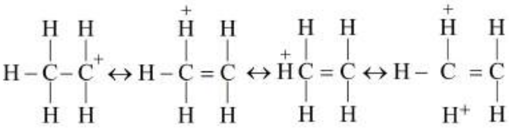
105. **(b)**

106. **(b)** Alkyl groups with at least one hydrogen atom on the α-carbon atom, attached to an unsaturated carbon atom, are able to release electrons in the following way.

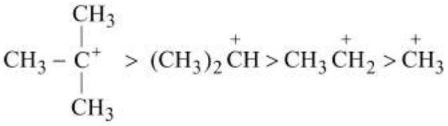


Note that the delocalisation involves σ and π bond orbitals (or *p* orbitals in case of free radicals) ; thus it is also known as σ – π **conjugation.** This type of *electron release due to the presence of the system* H—C—C = C is known as **hyperconjugation**

107. **(b)** The stability of carbocation on the basis of hyper-conjugation can be explained as hyperconjugation stabilises the carbocation because electron density from the adjacent π-bond helps in dispersing the positive charge.



In general greater the number of alkyl groups attached to a positively charged carbon atom, the greater is the hyperconjugation interaction and stabilisation of the cation. Thus, we have the following relative stability of carbocation.



$$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C^+}} > (CH_3)_2\overset{+}{C}H > CH_3\overset{+}{C}H_2 > \overset{+}{C}H_3$$

Hence, stability of carbocation is directly proportional to number of alkyl group directly attached to carbocations.

108. **(b)** Stability order of different alkyl carbocations on the basis of hyperconjugation is :

3° > 2° > 1° > methyl

In t-butyl cation, the C-atom bearing the positive charge is attached to three methyl groups therefore it possess nine α-hydrogens. It will give maximum nine hyperconjugative structures leading to maximum stability.

109. (b) In elimination reactions one or two molecules are lost from the substrate to form a multiple bond. Dehydration of ethanol is an example of elimination reaction.

$$C_2H_5OH \xrightarrow[H_2SO_4]{Conc} CH_2 = CH_2 + H_2O\,.$$

110. (a) **111. (d)** **112. (a)**

113. (b) Coloured impurities are removed by adsorbing over activated charcoal.

114. (a) This method is applied for the purification of substances which (i) are insoluble in water, (ii) are volatile in steam, (iii) are associated with non steam volatile impurities, (iv) have high molecular weights and (v) possess a fairly high vapour pressure at about the boiling point of water e.g. Aniline.

115. (a) Aniline is purified by steam distillation. A mixture of water and aniline boils at 371 K and 760 mm pressure which is less than boiling point of water.

116. (b) Among the given compounds naphthelene 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.

117. (d)

118. (b) If there is a small difference (10 or less) in the boiling points of liquids fractional distillation is used e.g. acetone b.p. 333 K and methanol b.p. 338 K.

119. (a) Fractional distillation is used for the distillation of petroleum. This method is used for separating a mixture of two or more miscible, volatile liquids having close (less than 40 degrees) boiling points. (For example, a mixture of acetone, b.p., 56°C and methanol, b.p. 65°C)

120. (c) If any liquid decomposes at its boiling point, it can be purified by vacuum distillation.

121. (c) Glycerol decomposes at its boiling point, hence it should be purified by distillation under reduced pressure.

122. (c) Vaccum distillation means distillation under reduced pressure.

123. (c)

124. (a) The latest technique for the purification of organic compounds is chromatography. These are of various types like column, paper and gas-chromatography.

125. (d) Both silica gel and alumina are used as adsorbents in adsorption chromatography.

126. (a) Chromatography paper contains water trapped in it, which acts as the stationary phase.

127. (c) The mixture of sugars is a homogenous one. Homogeneous mixtures of a solvent and one or more solutes (dissolved substances) are often separated by chromatography. Chromatography works to separate a mixture because the components of a mixture distribute themselves differently when they are in contact with a "two phase system". One phase is stationary and the other is moving or mobile. The stationary phase may be a solid packed in a tube or a piece of paper. The mobile phase may be liquid of gaseous.

128. (b) **129. (b)**

130. (b) Carbon and hydrogen are detected by heating the compound with copper (II) oxide. Carbon present in the compound is oxidised to CO_2 and hydrogen to H_2O.

131. (b)

132. (b) Hydrazine (NH_2NH_2) does not contain carbon and hence on fusion with Na metal, it cannot form NaCN; consequently hydrazine does not show Lassaigne's test for nitrogen.

133. (a) Prussian blue $Fe_4[Fe(CN)_6]_3$ is formed in lassaigne test for nitrogen.

$$3Na_4[Fe(CN)_6 + Fe^{3+} \longrightarrow \underset{\text{Prussian blue}}{Fe_4[Fe(CN)_4]_3} + 12Na^+$$

134. (d)

135. (d) Kjeldahl method is not applicable to any of the given compounds. As nitrogen of these compounds does not change to ammonium sulphate on heating with conc. H_2SO_4.

136. (c) **137. (b)**

138. (b) In Kjeldahl's method nitrogen is converted into $(NH_4)_2\,SO_4$, then to NH_3

139. (d) To increase the bpt of H_2SO_4,K_2SO_4 is added

140. (b) $$N\% = \frac{1.4 \times N \times V}{\text{wt.of organic compound}}$$

$$= \frac{1.4 \times 29 \times 1/5}{0.5} = 16.24\%$$

141. (b) $$\%\text{ of }S = \frac{32}{233} \times \frac{0.233}{0.32} \times 100 = 10\,\%$$

142. (c) As in above question,

$$C = \frac{40}{12} = 3.33;\ H = \frac{13.33}{1} = 13.33;\ N = \frac{46.67}{14} = 3.34$$

Relative No. of atoms,

$$C = \frac{3.33}{3.33} = 1;\ H = \frac{13.33}{3.33} = 4;\ N = \frac{3.34}{3.33} = 1$$

$\therefore$ Empirical formula $= CH_4N$

143. (b) $$\text{Percentage of P} = \frac{62}{222} \times \frac{\text{wt.of } Mg_2P_2O_7}{\text{wt.of compound}} \times 100$$

$$= \frac{62}{222} \times \frac{1.332}{2.79} \times 100 = 13.33\%$$

144. (a)

	% of element	Relative no. of atoms	Simple ratio
C	38.8	$\frac{38.8}{12}=3.2$	1
H	16.0	$\frac{16}{1}=16.0$	5
N	45.28	$\frac{45.28}{14}=3.2$	1

145. (b) Compound $\xrightarrow{\text{heat}}$ O_2 + Other gaseous products

$$2C+O_2 \xrightarrow{1373K} \underset{(A)}{2CO}$$

$$\underset{(B)}{I_2O_5}+\underset{(A)}{5CO} \rightarrow I_2+\underset{(C)}{5CO_2}$$

STATEMENT TYPE QUESTIONS

146. (c) A carbon having an *sp* hybrid orbital with 50% *s*-character is more electronegative than carbon atoms having sp^2 and sp^3 hybrid orbitals with 33% and 25% *s*-character respectively.
In $CH_2=C=CHCH_3$
Number of σ bonds :
$\sigma_{C-C}=3,\ \sigma_{C-H}=6$, total = 6 + 3 = 9
Number of π bonds = 2

147. (a) $\overset{\frown}{R}-\overset{\frown}{X} \xrightarrow[\text{light}]{\text{heat or}} \dot{R}+\dot{X}$

Above equation is an example of homolytic cleavge

148. (c) $-CH_3$ is an electron donating group.

149. (b) The resonance structures have same positions of nuclei and same number of unpaired electrons.

150. (b) Fractional distillation method is used if the difference in boiling points of two liquids is not much.

151. (d) For statement (ii),

$$R_F=\frac{\text{Distance moved by the substance from base line}}{\text{Distance moved by the solvent from base line}}$$

For statement (iv), amino acids sports may be detected by spraying the TLC plate with ninhydrin solution.

152. (b) K_2SO_4 raises bpt. and $CuSO_4$ acts as catalyst.

153. (d) When organic compound contains nitrogen, upon combustion it will produce oxides of nitrogen soluble in KOH solution. The copper will convert them into N_2

$$2NO+2Cu \longrightarrow 2CuO+N_2$$

$$2\,NO_2+4Cu \longrightarrow 4CuO+N_2 \text{ etc.}$$

Halogens will be removed as AgX. In case of sulphur SO_2 formed will be removed as $PbSO_4$.

MATCHING TYPE QUESTIONS

154. (b) **155. (c)** **156. (a)** **157. (c)** **158. (a)**
159. (a) **160. (d)** **161. (a)** **162. (b)** **163. (d)**
164. (c) **165. (a)**

ASSERTION-REASON TYPE QUESTIONS

166. (c) – CN is a secondary suffix.

167. (b)

168. (d) The correct name of the given compound is 2, 5, 6 -trimethyloctane

169. (c) **170. (d)**

171. (c) Benzene has a uniform C – C bond distance of 139 pm, a value intermediate between the C – C single. (154 pm) and C = C double (134 pm) bonds.

172. (a) It is fact that aniline is better nucleophile than anilium ion. Anilium ion contain +ve charge, which reduces the tendency to donate lone pair of electron $\underset{\text{Anilium ion}}{C_6H_5NH_3^+}$.

173. (d) Resonance structures contain the same number of unpaired electrons. However, they differ in the way of distribution of electrons.

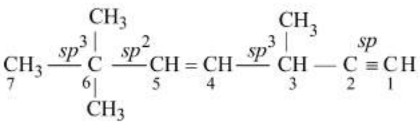
174. (d) **175. (a)** **176. (a)** **177. (c)**

CRITICAL THINKING TYPE QUESTIONS

178. (a) It is derivative of ethanamide having N-phenyl group.

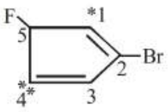
179. (b) The compound contains longest chain of 5C - atoms and e of ene is retained as the suffix name starts with constant

180. (d)



$$\underset{7}{CH_3}\overset{sp^3}{—}\underset{6}{\overset{CH_3}{C}}(CH_3)\overset{sp^2}{—}\underset{5}{CH}=\underset{4}{CH}\overset{sp^3}{—}\underset{3}{\overset{CH_3}{CH}}—\underset{2}{\overset{sp}{C}}\equiv\underset{1}{CH}$$

181. (d)



The numbering of C-atom starts from $\overset{*}{C}$ or $\overset{**}{C}$. But numbering from $\overset{*}{C}$ give minimum locant (2) to Br which is correct.

182. (a) 

No. of σ bonds = 12 ; No. of π bonds = 3

∴ Ratio of π : σ bonds = 3 : 12 = 1 : 4

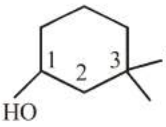
183. (a) In compounds (i), (iii) and (iv), all carbon atoms are *sp*³, *sp*² and *sp* hybridised, respectivley. However, compound (ii) has *sp*² and *sp*³ hybridised carbon atoms;

$$\overset{sp^3}{CH_3}-\overset{sp^2}{CH}=\overset{sp^2}{CH}-\overset{sp^3}{CH_3}$$

184. (a)

185. (c) See the number of σ bonds formed by $\overset{x}{C}$ in each case.

In $H\overset{x}{C}OOH$, $(H_2N)_2\overset{x}{C}O$ and $CH_3\overset{x}{C}HO$, $\overset{x}{C}$ forms 3σ bonds and 1 π bond, hybridisation is sp². In $(CH_3)_3\overset{x}{C}OH$, $\overset{x}{C}$ forms 4σ bonds, hence hybridisation is sp³

186. (a) 

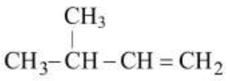
IUPAC name – 3, 3-Dimethyl -1 cyclohexanol

187. (d) The compound contains longest chain of 3 C - atoms and three -COOH groups and one -OH group attached to it (latest convention).

188. (c) C_5H_{10} has 1° degree of unsaturation since the isomers are acyclic, all of these are alkenes. For writing the isomers, first introduce the double bond at different possible positions, and then consider the possibility of branching in the alkyl group.

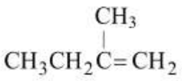
$CH_3CH_2CH_2CH{=}CH_2$ — 1-pentene (*i*)

$CH_3CH_2CH{=}CHCH_3$ — 2- pentene, (*cis,- trans*) (*ii*), (*iii*)



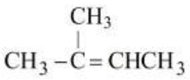
$CH_3-\overset{\overset{CH_3}{|}}{CH}-CH=CH_2$

3-methyl-1-butene, (*iv*)



$CH_3CH_2\overset{\overset{CH_3}{|}}{C}=CH_2$

2-methyl-1-butene, (*v*)



$CH_3-\overset{\overset{CH_3}{|}}{C}=CHCH_3$

2-methyl-2-butene, (*vi*)

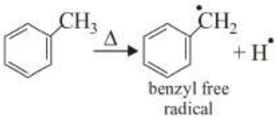
189. (b) **190. (d)**

191. (c) Metamerism shown among compounds of the same functional group.

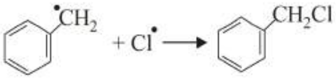
192. (b) – I group destablises carbocation and since inductive effect decreases with increasing length of carbon chain. Therefore (b) is the correct option.

193. (d) $-NO_2$ group, being strong electron-withdrawing, disperses the –ve charge, hence stabilizes the concerned carbanion.

194. (b) In the presence of UV rays or energy, by boiling chlorine, free radical is generated which attack the methyl carbon atom of the toluene.



$$Cl_2 \xrightarrow{h\nu} 2Cl^{\bullet}$$



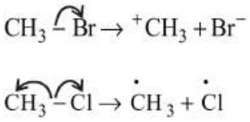
195. (c) Cl^- is the best leaving group among the given option.

196. (a) Nucleophilicity increases down the periodic table.

$$I^- > Br^- > Cl^- > F^-$$

197. (b) $H_2C=CHCl$ is capable of showing resonance which develops a partial double bond character on C–Cl bond, thereby making it less reactive toward nucleophilic substitution.

$$H_2C=CH-\ddot{\underset{..}{Cl}}: \longleftrightarrow H_2\bar{C}-CH=Cl^+$$

198. (d) 

$$CH_3-Br \rightarrow {}^{+}CH_3 + Br^-$$

$$CH_3-Cl \rightarrow \dot{C}H_3 + \dot{C}l$$

199. (d) To convert covalent compounds into ionic compounds such as NaCN, Na_2S, NaX, etc.

200. (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 in than o-nitrophenol due to presence of inter molecular hydrogen bonding hence they can be separated by steam distillation.

201. (b) Na_2S and NaCN, formed during fusion with metallic sodium, must be removed before adding $AgNO_3$, otherwise black ppt. due to Na_2S or white precipitate due to AgCN will be formed and thus white precipitate of AgCl will not be identified easily.

$$Na_2S + 2AgNO_3 \longrightarrow 2NaNO_3 + \underset{\text{Black}}{Ag_2S} \downarrow$$

$$NaCN + AgNO_3 \longrightarrow NaNO_3 + \underset{\text{White}}{AgCN} \downarrow$$

$$NaCl + AgNO_3 \longrightarrow NaNO_3 + \underset{\text{white}}{AgCl} \downarrow$$

$$Na_2S + 2HNO_3 \xrightarrow{\text{boil}} 2NaNO_3 + H_2S \uparrow$$

$$NaCN + HNO_3 \xrightarrow{\text{boil}} NaNO_3 + HCN \uparrow$$

202. (d) The compounds with odd number of N-atoms have odd masses and with even number of N-atoms have even masses. This is "nitrogen rule".

203. (b) Percentage of N in a compound

$$= \frac{1.4 \times \text{Normality of acid} \times \text{Volume of acid used}}{\text{Mass of the substance taken}}$$

Given, 0.5 M H_2SO_4 is used.

Normality = Molarity × n

where n $= \frac{\text{Mol.mass}}{\text{Eq.mass}} = \frac{98}{49} = 2$

$\therefore$ Normality = 0.5 × 2 = 1 N H_2SO_4

Volume of acid used to neutralise

$NH_3 = 10\ cm^3$

Mass of organic compound taken = 0.25 g

$\therefore$ $\%N = \frac{1.4 \times 1 \times 10}{0.25} = 56.$

204. (d)