

CHEMISTRY

1. Which of the following metals is/are in liquid state below 30°C ?
i. Mercury ii. Gallium iii. Rubidium iv. Cesium
(A) i only
(B) i and ii
(C) i and iii
(D) i, ii and iv
2. The names “Chalcogens” and “Pnictogens” represent
(A) Group 14 and Group 15 elements respectively
(B) Group 16 and Group 15 elements respectively
(C) Group 15 and Group 14 elements respectively
(D) Group 15 and Group 16 elements respectively
3. The name ‘coinage metals’ denotes which of the following group of metals?
(A) Cu and Fe
(B) Cu and Ag
(C) Cu, Ag and Fe
(D) Cu, Ag and Au
4. The only radioactive element in the lanthanide series is
(A) Lanthanum
(B) Promethium
(C) Gadolinium
(D) Samarium
5. Among the fluorides of alkali metals, the lowest solubility of LiF in water is due to the
(A) ionic nature of lithium fluoride
(B) high lattice enthalpy
(C) high hydration enthalpy for lithium ion
(D) low ionisation enthalpy of lithium atom

6. Which of the following properties are the special characteristics of alkali metals?

- (i) High boiling point
- (ii) High negative standard electrode potential
- (iii) High density
- (iv) Large atomic size

- (A) i and ii
- (B) i and iv
- (C) ii and iv
- (D) iii and ii

7. Which of the following compounds are readily soluble in water?

- (i) BeSO_4 (ii) MgSO_4 (iii) BaSO_4 (iv) SrSO_4

- (A) (i) and (ii)
- (B) (iii) and (iv)
- (C) (ii) and (iv)
- (D) (i) and (iv)

8. Find the correct formula of halides of alkaline earth metals from the following.

- (i) $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$
- (ii) $\text{BaCl}_2 \cdot 4\text{H}_2\text{O}$
- (iii) $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$
- (iv) $\text{SrCl}_2 \cdot 4\text{H}_2\text{O}$

- (A) (ii) and (iii)
- (B) (iv) and (ii)
- (C) (iv) and (i)
- (D) (i) and (iii)

9. Match the correct pairs:

Elements		Properties	
(i)	Li	(a)	Insoluble sulphate
(ii)	Na	(b)	Strongest monoacidic base
(iii)	Ca	(c)	Most negative E° value among alkali metals
(iv)	Ba	(d)	Insoluble oxalate

- (A) (i) - (b); (ii) - (c); (iii) - (d); (iv) - (a)
- (B) (i) - (c); (ii) - (b); (iii) - (d); (iv) - (a)
- (C) (i) - (b); (ii) - (c); (iii) - (a); (iv) - (d)
- (D) (i) - (c); (ii) - (b); (iii) - (a); (iv) - (d)

10. Match the following pairs.

	Elements	Colour they impart to the flame
(i)	Cs	(a) Apple green
(ii)	Ca	(b) Brick red
(iii)	Sr	(c) Crimson red
(iv)	Ba	(d) Blue

- (A) (i) - (c); (ii) - (a); (iii) - (d); (iv) - (b)
(B) (i) - (a); (ii) - (c); (iii) - (b); (iv) - (d)
(C) (i) - (b); (ii) - (d); (iii) - (a); (iv) - (c)
(D) (i) - (d); (ii) - (b); (iii) - (c); (iv) - (a)

11. A dehydrating agent commonly used in the laboratory is

- (A) MgCO_3
(B) CaF_2
(C) CaCl_2
(D) MgF

12. The correct sequence of the increasing basic nature of the given oxides is

- (A) $\text{K}_2\text{O} < \text{Na}_2\text{O} < \text{Al}_2\text{O}_3 < \text{MgO}$
(B) $\text{Al}_2\text{O}_3 < \text{MgO} < \text{Na}_2\text{O} < \text{K}_2\text{O}$
(C) $\text{MgO} < \text{K}_2\text{O} < \text{Al}_2\text{O}_3 < \text{Na}_2\text{O}$
(D) $\text{MgO} < \text{K}_2\text{O} < \text{Na}_2\text{O} < \text{Al}_2\text{O}_3$

13. Which alkali metal does possess the highest ionization potential?

- (A) Na
(B) Li
(C) Rb
(D) Cs

14. Alkali and alkaline earth metals exhibit coloured flame when heated over burner, which is due to

- (A) smaller electronegativity of alkali metals
(B) smaller ionic radius of these metals
(C) de-excitation of electrons from higher energy levels to lower energy level
(D) excitation of electrons from low energy levels to higher energy levels

15. Sodium is not observed in +2 oxidation state because of its
- (A) high first ionization potential
 - (B) high second ionization potential
 - (C) high ionic radius
 - (D) high electronegativity
16. The oxides of beryllium are
- (A) acidic
 - (B) basic
 - (C) neutral
 - (D) amphoteric
17. Sodium metal is kept under
- (A) water
 - (B) alcohol
 - (C) kerosene
 - (D) benzene
18. Aluminium is more reactive but less easily corroded than iron, because
- (A) aluminium is noble metal
 - (B) oxygen forms a protective oxide layer
 - (C) iron undergoes reaction easily with water
 - (D) iron forms mono and divalent ions
19. Inorganic benzene is
- (A) B_2H_6
 - (B) $B_3N_3H_6$
 - (C) $B_3O_3H_6$
 - (D) $P_3N_3H_6$
20. Reaction of PCl_3 and $PhMgBr$ would give
- (A) Bromobenzene
 - (B) Chlorobenzene
 - (C) Triphenylphosphine
 - (D) Dichlorobenzene

21. Percentage of Au in 20 carat gold ornaments is
- (A) 91.6%
 - (B) 83.3%
 - (C) 85.4%
 - (D) 87.5%
22. Which of the following is used in dry cell?
- (A) KMnO_4
 - (B) MnO_2
 - (C) $\text{K}_2\text{Cr}_2\text{O}_7$
 - (D) K_2MnO_2
23. The alloy used to fill dental cavities is
- (A) Sodium amalgam
 - (B) Zinc chloride
 - (C) Mercury
 - (D) Mercury amalgam
24. The catalyst used in the Haber process for the manufacture of NH_3 is
- (A) Pt
 - (B) Fe + Mo
 - (C) CuO
 - (D) Al_2O_3
25. Predict the group of elements which has completely filled d-orbitals
- (A) Ag, Pd, Pt
 - (B) Zn, Hg, Ir
 - (C) Ag, Au, Pt
 - (D) Pd, Au, Ag
26. Which of the following has highest value of their second ionization enthalpy?
(Atomic number of V, Cr, Mn and Fe are 23, 24, 25 and 26 respectively)
- (A) V
 - (B) Cr
 - (C) Mn
 - (D) Fe

27. Which among the following is due to the lanthanide contraction?
- (A) Zn and Zr have same oxidation state
 - (B) Zr and Hf have same covalent and ionic radius
 - (C) Zr and Nb have same oxidation state
 - (D) Zr and Yb have same covalent and ionic radius
28. Which group of ions have d^2 configuration?
- (A) Ti^{3+} , V^{2+} , Cr^{3+} , Mn^{4+}
 - (B) Ti^{1+} , V^{4+} , Cr^{6+} , Mn^{7+}
 - (C) Ti^{4+} , V^{3+} , Cr^{2+} , Mn^{3+}
 - (D) Ti^{2+} , V^{3+} , Cr^{4+} , Mn^{5+}
29. What is the atomic number of the element with the electronic configuration $[Kr] 4d^{10}$?
- (A) 46
 - (B) 48
 - (C) 47
 - (D) 45
30. $[Co(NH_3)_6]^{3+}$ ion is :
- (A) Paramagnetic
 - (B) Diamagnetic
 - (C) Square planar
 - (D) Trigonalbipyramidal
31. The type of isomerism shown by $[Co(en)_2(NCS)_2]Cl$ and $[Co(en)_2(NCS)Cl]NCS$ is
- (A) Coordination
 - (B) Ionization
 - (C) Linkage
 - (D) All of the above
32. Diethylene triamine is an example of
- (A) Monodentate ligand
 - (B) Bidentate ligand
 - (C) Tridentate ligand
 - (D) Hexadentate ligand

33. Number of possible optical isomers in $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ is
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 6
34. Which one of the following is true according to the postulates of Werner's theory for coordination compounds?
- (A) Primary valencies are ionizable
 - (B) Secondary valencies are ionizable
 - (C) Only primary valencies are non-ionizable
 - (D) Primary and secondary valencies are non-ionizable
35. Predict the correct order of the increasing field strength of the ligands NH_3 , ethylenediamine (en), CN^- and CO.
- (A) $\text{CO} < \text{NH}_3 < \text{en} < \text{CN}^-$
 - (B) $\text{NH}_3 < \text{en} < \text{CN}^- < \text{CO}$
 - (C) $\text{CN}^- < \text{NH}_3 < \text{CO} < \text{en}$
 - (D) $\text{en} < \text{CN}^- < \text{NH}_3 < \text{CO}$
36. Among the following, which metal forms an organometallic bond in the Grignard reaction?
- (A) Sodium
 - (B) Titanium
 - (C) Magnesium
 - (D) Palladium
37. Zeigler-Natta catalyst is used for which type of reaction.
- (A) Hydrogenation
 - (B) Polymerisation
 - (C) Oxidation
 - (D) Reduction

38. What is the oxidation state of chromium in $\text{Na}_2[\text{CrF}_4\text{O}]$ complex?
- (A) II
(B) III
(C) IV
(D) VI
39. The geometries of $\text{Zn}(\text{CN})_4^{2-}$ and $\text{Ni}(\text{CN})_4^{2-}$ are
- (A) tetrahedral and square planar respectively
(B) tetrahedral and tetrahedral respectively
(C) square planar and tetrahedral respectively
(D) square planar and square planar respectively
40. In which of the following reaction, Wilkinson's catalyst is used?
- (A) Polymerisation
(B) Condensation
(C) Halogenation
(D) Hydrogenation
41. Which one of the following halides is soluble in water?
- (A) AgF
(B) AgCl
(C) AgBr
(D) AgI
42. The metal whose salts do not give the borax bead test is
- (A) Cr
(B) Pb
(C) Ni
(D) Mn
43. Formation of a rose-red precipitate, when a slightly alkaline solution of an inorganic salt is treated with dimethylglyoxime, confirms the presence of
- (A) Fe
(B) Co
(C) Ni
(D) Zn

44. An example for interfering radical is
- (A) Phosphate
 - (B) Sulphate
 - (C) Sulphide
 - (D) Nitride
45. Which of the following pairs of ions are not precipitated while adding acidic solution of H_2S ?
- (A) Cu^{2+} , Cd^{2+}
 - (B) Bi^{3+} , As^{3+}
 - (C) Sb^{3+} , Sn^{4+}
 - (D) Hg^{2+} , Ni^{2+}
46. Nitric acid is generally not used for preparation of original solution in analysis of basic radicals, because
- (A) it is a strong oxidising agent
 - (B) it is a reducing agent
 - (C) it forms insoluble nitrates
 - (D) nitrate ions cause interference with the scheme of analysis
47. CFSE of a cobalt(III) octahedral complex is
- (A) $-24 Dq$
 - (B) $-24 Dq + 3 P$
 - (C) $-24 Dq + 2 P$
 - (D) $-12 Dq + 2 P$
48. The d orbital splitting in a square planar field is
- (A) $d_{x^2-y^2} > d_{xy} > d_{z^2} > d_{xz} = d_{yz}$
 - (B) $d_{x^2-y^2} > d_{z^2} > d_{xy} > d_{xz} = d_{yz}$
 - (C) $d_{x^2-y^2} > d_{xy} > d_{xz} = d_{yz} > d_{z^2}$
 - (D) $d_{xy} > d_{x^2-y^2} > d_{xz} = d_{yz} > d_{z^2}$

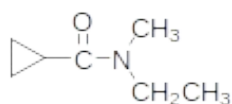
49. The metal present in hemocyanin is

- (A) Fe
- (B) Cu
- (C) Fe and Zn
- (D) Mo

50. A nickel complex is red in colour and is diamagnetic. The structure of the complex is

- (A) octahedral
- (B) tetrahedral
- (C) square pyramidal
- (D) square planar

51. IUPAC name of the following compound



- (A) N-Ethyl-N-methylcyclopropanamide
- (B) N-Ethyl-N-methylcyclopropanecarboxamide
- (C) N-methyl-N-ethylcyclopropanamide
- (D) N-cyclopropanoyl-N-methylethanamine

52. Alkanamines have the general formula

- (A) $C_n H_{2n-1} N$
- (B) $C_n H_{2n+1} N$
- (C) $C_n H_{2n+3} N$
- (D) $C_n H_{2n-3} N$

53. Index of hydrogen deficiency for C_6N_4 is

- (A) 9
- (B) 5
- (C) 7
- (D) 4

54. Steam distillation is applicable for the separation and purification of organic compounds which

- (i) are insoluble in H_2O
- (ii) are volatile in steam
- (iii) possess a high vapour pressure at 373 K
- (iv) contain non-volatile impurities

- (A) (i), (ii)
- (B) (ii), (iii)
- (C) (i), (ii), (iii)
- (D) (i), (ii), (iii), (iv)

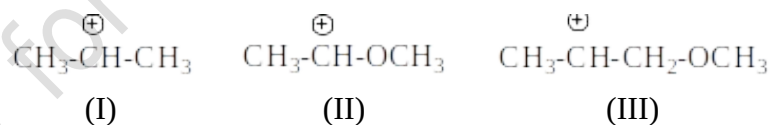
55. In which of the following, functional group isomerism is not possible

- (A) C_2H_6O
- (B) $C_2H_4O_2$
- (C) C_2H_5Cl
- (D) C_2H_3N

56. The principle involved in paper chromatography is

- (A) Adsorption
- (B) Differential solubility
- (C) Partition
- (D) Size exclusion

57. The correct stability order of the following cations



- (A) (II) > (I) > (III)
- (B) (II) > (III) > (I)
- (C) (III) > (I) > (II)
- (D) (I) > (II) > (III)

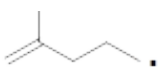
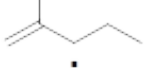
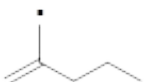
58. The state of hybridization of C_1 and C_3 in $CH_2=C=CH-CN$

- (A) sp and sp^2
- (B) sp^2 and sp
- (C) Both sp^2
- (D) Both sp

59. Among the following, strongest Hydrogen bonds are present in

- (A) $\text{CH}_3\text{CO}_2\text{H}$
- (B) $\text{CH}_3\text{CH}_2\text{NH}_2$
- (C) $\text{CH}_3\text{CH}_2\text{OH}$
- (D) $\text{CH}_3\text{CH}_2\text{SH}$

60. Which of the following free radicals is most stable?

- (A) 
- (B) 
- (C) 
- (D) 

61. Cyclopentadienyl anion is

- (A) anti-aromatic
- (B) aromatic
- (C) non-aromatic
- (D) homoaromatic

62. Higher stability of but-2-ene over but-1-ene is attributable to

- (A) Inductive effect
- (B) π -delocalization
- (C) Steric effect
- (D) Hyperconjugative effect

63. Hunsdiecker reaction proceeds by mechanism.

- (A) Carbocation
- (B) Carbanion
- (C) Free radical
- (D) Nitrene

64. The compound/s which shows tautomerism is/are



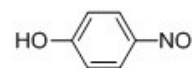
(I)



(II)



(III)



(IV)

- (A) (I) only
- (B) (I), (II), (III), (IV)
- (C) (IV) only
- (D) (II) and (III)

65. The most stable conformer of ethylene glycol ($\text{HO}-\text{CH}_2-\text{CH}_2\text{OH}$)

- (A) Gauche
- (B) Staggered
- (C) Anti
- (D) Eclipsed

66. Number of π -electrons in cyclobutadienyl anion

- (A) 2
- (B) 3
- (C) 4
- (D) 6

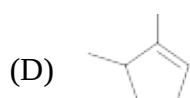
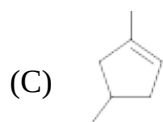
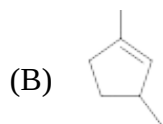
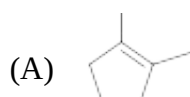
67. Which among the following reactions proceeds through a radical intermediate?

- (A) $\text{CH}_3-\text{CH}=\text{CH}_2 + \text{HBr} \longrightarrow \text{CH}_3-\text{CH}(\text{Br})\text{CH}_3$
- (B) $\text{CH}_3-\text{CH}=\text{CH}_2 + \text{HBr} \longrightarrow \text{CH}_3-\text{CH}_2-\text{CH}_2\text{Br}$
- (C) $\text{CH}_3-\text{CH}=\text{CH}_2 + \text{Br}_2 \longrightarrow \text{CH}_3-\text{CH}(\text{Br})\text{CH}_2(\text{Br})$
- (D) $\text{CH}_3-\text{CH}=\text{O} + \text{HCN} \longrightarrow \text{CH}_3\text{CH}(\text{OH})\text{CN}$

68. Which of the following statements is not true for $\text{S}_{\text{N}}1$ substitution reaction?

- (A) The rate of reaction does not depend on the molar concentration of the nucleophile
- (B) Is accelerated by nonpolar solvents
- (C) The rate of reaction is altered by the addition of electrolyte
- (D) $\text{E}1$ elimination completes with $\text{S}_{\text{N}}1$ substitution

69. Which compound would give 5-oxo-4-methylhexanal upon ozonolysis?



70. Which among the following compounds does not show geometrical isomerism?

- (A) 2,3-dimethylbut-2-ene
- (B) 1,2-dibromopropene
- (C) 2,3-dibromobut-2-ene
- (D) 3-methylpent-2-ene

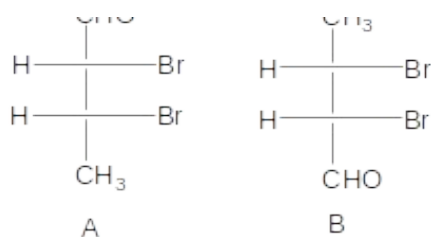
71. How many isomers of $C_5H_{11}OH$ will be primary alcohols?

- (A) 2
- (B) 3
- (C) 4
- (D) 5

72. The number of possible stereoisomers for a compound of the structural formula $CH_3-CH=CH-CH(OH)-CH_3$ is

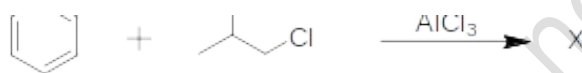
- (A) 6
- (B) 4
- (C) 3
- (D) 2

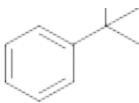
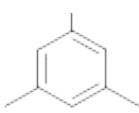
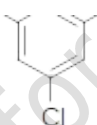
73. The correct statement about compounds A and B are



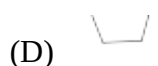
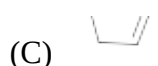
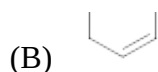
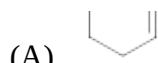
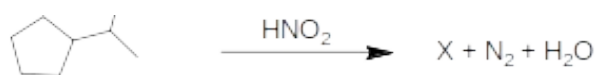
- (A) A and B are identical
- (B) A and B are enantiomers
- (C) A and B diastereomers
- (D) None of the above

74. Major product X formed in the following reaction is

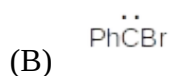


- (A) 
- (B) 
- (C) 
- (D) 

75. The stable product (X) formed in the following reaction



76. Major carbene intermediate (X) formed in the following reaction



77. Consider the following reaction



The structure of C₃H₆Cl₂

- (A) 1,1-dichloropropane
- (B) 2,2-dichloropropane
- (C) 1,2-dichloropropane
- (D) 1,3-dichloropropane

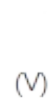
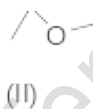
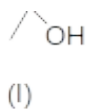
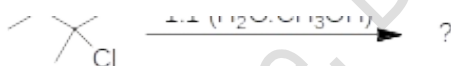
78. The IUPAC name of the major product X formed in the following reaction when the two reagents are taken in a 1:1 molar ratio is:



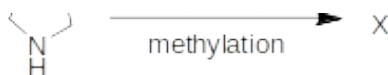
- (A) ethoxy-2-bromoethane
 (B) ethoxy-2-chloroethane
 (C) 2-chloroethoxyethane
 (D) 1-chloroethoxyethane
79. How many monohalogenated hydrocarbons, including stereoisomers are possible when 2-methylbutane is chlorinated?

- (A) 3
 (B) 4
 (C) 5
 (D) 6

80. Choose the correct set of products formed in the following reaction

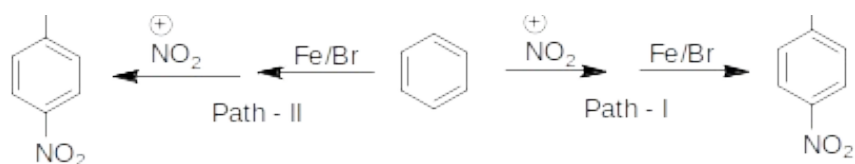


- (A) All five products
 (B) (I), (II), (IV), (V)
 (C) (I) only
 (D) (I) and (IV)
81. The product (X) of the following deamination reaction via Hofmann exhaustive methylation is



- (A)
- (B)
- (C)
- (D)

82. Which path is most suitable for the preparation of 4-bromonitrobenzene?

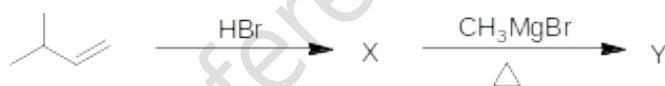


- (A) (I)
- (B) (II)
- (C) Either (I) or (II)
- (D) Neither (I) nor (II)

83. Major product/products formed when ethanol is heated with bleaching powder followed by acidification is/are

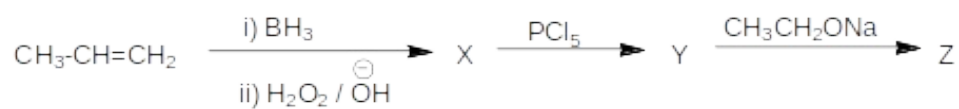
- (A) CHCl_3 and formic acid
- (B) CH_3CHO
- (C) $\text{CH}_3\text{CO}_2\text{H}$
- (D) $\text{ClCH}_2\text{CH}_2\text{OH}$

84. Product Y obtained in the following reaction sequence is



- (A)
- (B)
- (C)
- (D)

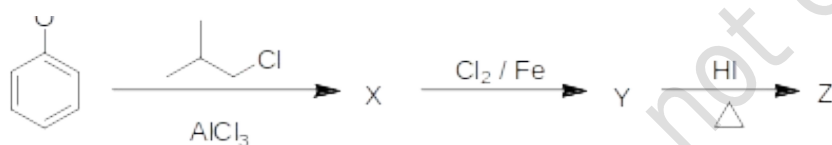
85. Consider the following sequence of reactions



The final product Z is

- (A) propionic acid
- (B) propyne
- (C) 2-ethoxypropane
- (D) 1-ethoxypropane

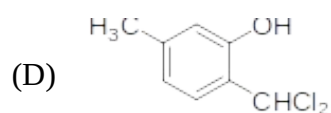
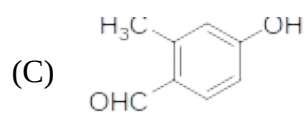
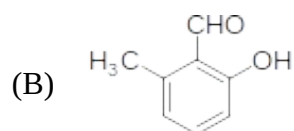
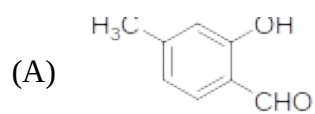
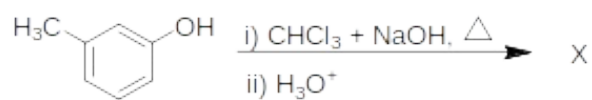
86. Consider the following sequence of reaction



Which among the following is formed as the major product Z?

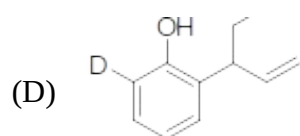
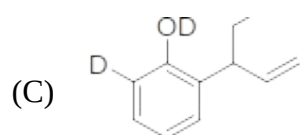
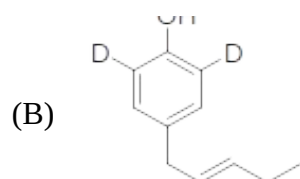
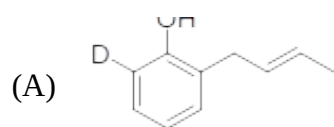
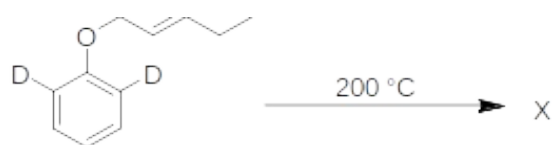
- (A)
- (B)
- (C)
- (D)

87. Major product (X) in the following reaction is

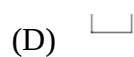
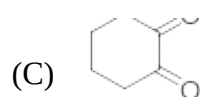
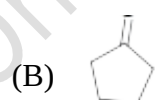
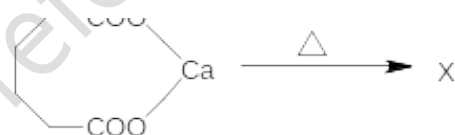


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88. Major product (X) in the following reaction is



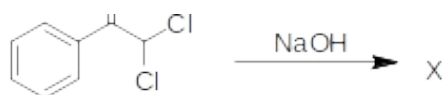
89. Major product (X) formed in the following reaction is



90. The number of aldol products (excluding stereoisomers) formed when a 1:1 mixture of propanal and ethanal is treated with alkali is:

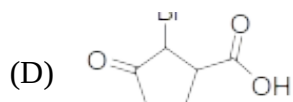
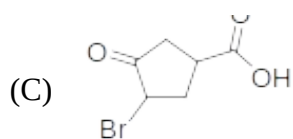
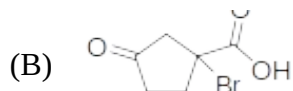
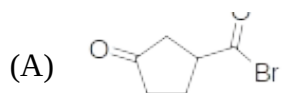
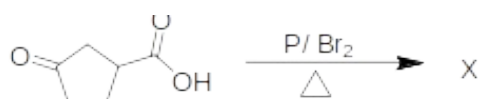
- (A) 2
- (B) 6
- (C) 8
- (D) 4

91. Major product (X) in the following reaction is

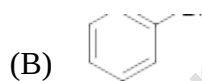
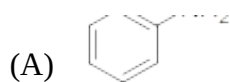
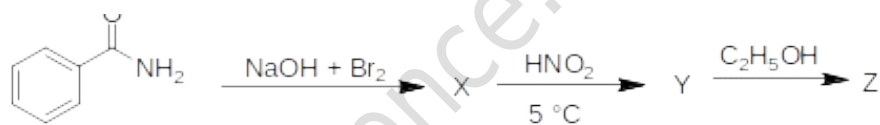


- (A)
- (B)
- (C)
- (D)

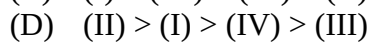
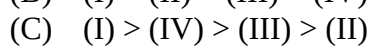
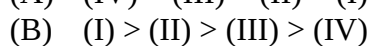
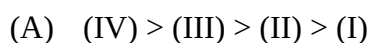
92. The product (X) in the following is



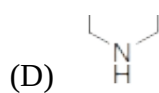
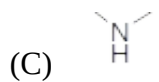
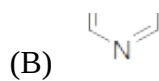
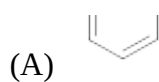
93. Major product (Z) in the following reaction sequence is



94. The reactivity of $RCOCl$ (I), $RCOOCOR$ (II), $RCOOR$ (III) and $RCONH_2$ (IV) with nucleophilic reagents follows the order

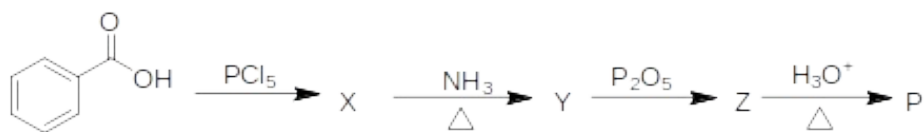


95. The strongest base among the following compounds is



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96. The final product (P) in the following reaction is

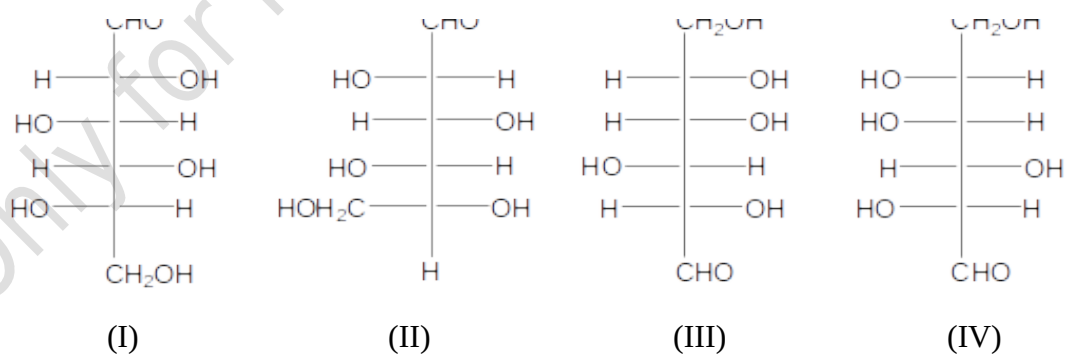


- (A)
- (B)
- (C)
- (D)

97. Nitrobenzene can be reduced to phenylhydroxylamine (PhNHOH) using

- (A) Sn/HCl
(B) $(\text{NH}_4)_2\text{S}$
(C) Pd/H₂
(D) Zn/NH₄Cl

98. Which of the following will form the same aldarc acid on oxidation with dil. HNO₃?



- (A) (I), (II)
(B) (II), (III)
(C) (III), (IV)
(D) (IV), (I)

99. A tripeptide contains glycine, alanine and serine. How many different sequences are possible?
- (A) 6
 - (B) 8
 - (C) 5
 - (D) 4
100. Bakelite is a condensation polymer formed from
- (A) Phenol and formaldehyde
 - (B) Urea and formaldehyde
 - (C) Terephthalic acid and ethylene glycol
 - (D) Melamine and formaldehyde
101. Zero-point energy of harmonic oscillator
- (A) $\frac{1}{2}h\nu$
 - (B) $h\nu$
 - (C) zero
 - (D) $-\frac{1}{2}h\nu$
102. 1 eV =
- (A) 1.38×10^{-23} J
 - (B) 1.602×10^{-19} J
 - (C) 4.186 J
 - (D) 8.314 J
103. The wavelength of electromagnetic radiation of wave number $1.5 \times 10^6 \text{ m}^{-1}$
- (A) 660 nm
 - (B) 66 nm
 - (C) 6.6 nm
 - (D) 0.66 nm

104. The mean relative speed, v_{rel} , is

- (A) $v_{\text{rel}} = 2^{1/2} v_{\text{mean}}$
- (B) $v_{\text{rel}} = (2RT) v_{\text{mean}}$
- (C) $v_{\text{rel}} = (1/2RT) v_{\text{mean}}$
- (D) $v_{\text{rel}} = (\log 2) v_{\text{mean}}$

105. Choose the correct expression.

- (A) $1 \text{ A} = 1 \text{ Cs}^{-1}$, where A is ampere and C is coulombs
- (B) $1 \text{ A} = 1 \text{ Cs}$, where A is ampere and C is coulombs
- (C) $1 \text{ A} = 1 \text{ V ohm}^{-1}$
- (D) $1 \text{ A} = 1 \text{ V s}^{-1}$

106. The is the variation of internal energy with volume at constant temperature.

- (A) Joule-Thomson effect
- (B) isenthalpic expansion
- (C) heat capacity
- (D) internal pressure

107. The principal axis in benzene

- (A) C_3
- (B) S_3
- (C) C_2
- (D) C_6

108. A differential scanning calorimeter measures the

- (A) Weight
- (B) Temperature
- (C) Heat capacity
- (D) Energy transferred as heat

109. Choose the molecules belonging to the point group C_{2v}

I. H_2O

II. CH_2Cl_2

III. C_6H_5Cl

IV. NH_3

(A) I, II and III

(B) IV only

(C) II and IV

(D) None of the above

110. Number of symmetry operations associated with C_{3v}

(A) 2

(B) 4

(C) 3

(D) 6

111. The selection rule for anharmonic oscillator
- (A) $\Delta v = 0$
 - (B) $\Delta v = \pm 1, \pm 2, \pm 3 \dots$
 - (C) $\Delta v = \pm 1$
 - (D) $\Delta v = \pm 1/2$
112. $a \neq b \neq c$ and $\gamma \neq \alpha = \beta = 90^\circ$ belong to the class
- (A) Monoclinic
 - (B) Cubic
 - (C) Orthorhombic
 - (D) Tetragonal
113. Which molecule belongs to asymmetric top type?
- (A) O_3
 - (B) HCN
 - (C) CH_4
 - (D) NH_3
114. Pick out the molecule showing both microwave and infrared spectra:
 Br_2, CS_2, HBr, H_2
- (A) HBr
 - (B) H_2
 - (C) Br_2
 - (D) CS_2
115. Ramachandran plot
- (A) The logarithmic dependence of the molar Gibbs energy on the pressure
 - (B) A contour diagram of potential energy against the angles Ψ and ϕ
 - (C) $\log k$ vs $1/T$
 - (D) Internal energy, V vs Temp

116. Which of the following are nonlinear operators?

I. $\hat{A} f(x) = \text{SQR } f(x)$

II. $\hat{A} f(x) = 0$

III. $\hat{A} f(x) = \ln f(x)$

IV. $\hat{A} f(x) = [f(x)]^{-1}$

(A) none

(B) all

(C) II Only

(D) I, III and IV

117. Number of vibrational degrees of freedom of CO_2

(A) 4

(B) 2

(C) 3

(D) 0

118. Unit of g-factor

(A) dimensionless

(B) s^{-1}

(C) $^{\circ}\text{C}$

(D) mol^{-1}

119. Point group of *trans* $\text{CHCl}=\text{CHCl}$

(A) C_{2h}

(B) C_{3v}

(C) $\text{C}_{\infty v}$

(D) C_1

120. Which one of the following molecules does not have IR active vibrations?

(A) NO

(B) H_2

(C) N_2O

(D) CH_4

121. Pick out the spherical rotors: CH_4 , CH_3Cl , C_6H_6 and HCl

- (A) HCl
- (B) C_6H_6
- (C) CH_4
- (D) C_6H_6 and HCl

122. Pick out the ion possessing the high value of equivalent conductance at infinite dilution?

- (A) OH^-
- (B) H^+
- (C) Li^+
- (D) F^-

123. The point group associated with a linear molecule

- (A) $\text{C}_{\infty\text{v}}$ and $\text{D}_{\infty\text{h}}$
- (B) $\text{C}_{\infty\text{v}}$ only
- (C) C_1
- (D) $\text{D}_{\infty\text{h}}$ only

124. Number of one-dimensional irreducible representations associated with $\text{C}_{2\text{v}}$ point group

- (A) 6
- (B) 3
- (C) 4
- (D) 1

125. Which one of the following molecules is microwave active?

HCl , H_2 , CH_4 and SF_6

- (A) HCl
- (B) H_2
- (C) SF_6
- (D) CH_4

126. Lowest energy electronic transition

- (A) $\pi \rightarrow \pi^*$
- (B) $n \rightarrow \pi^*$
- (C) $n \rightarrow \sigma^*$
- (D) $\sigma \rightarrow \sigma^*$

127. Ionic strength of uni-univalent electrolyte is equal to

- (A) zero
- (B) molarity
- (C) one
- (D) infinity

128. X-rays are used in spectroscopy.

- (A) UV
- (B) IR
- (C) Photoelectron
- (D) ESR

129. Symmetry number of methane

- (A) 6
- (B) 12
- (C) 3
- (D) 0

130. Root – mean – square speed of NO_2 at 25°C

- (A) 515 ms^{-1}
- (B) 5.15 ms^{-1}
- (C) 0.515 ms^{-1}
- (D) 51.5 ms^{-1}

131. Spin angular momentum of a photon

- (A) $1.49 \times 10^{-23} \text{ Js}$
- (B) $1.49 \times 10^{-34} \text{ Js}$
- (C) $1.49 \times 10^{-10} \text{ Js}$
- (D) $1.49 \times 10^{-2} \text{ Js}$

132. Pick out the Boson

- (A) proton
- (B) neutron
- (C) deuteron
- (D) electron

133. Essential symmetry of triclinic system

- (A) one C_3 axis
- (B) none
- (C) one C_6 axis
- (D) one C_2 axis

134. Choose the Fermion(s) from the following: photons, deuterons, electrons and protons

- (A) photons and deuterons
- (B) electrons and protons
- (C) deuterons and protons
- (D) photons and electrons

135. The half-life of a second order reaction

- (A) $t_{1/2} = \frac{1}{k[A]_0}$, where $[A]_0$ is initial concentration
- (B) $t_{1/2} = \frac{0.693}{k}$, where $[A]_0$ is initial concentration
- (C) $t_{1/2} = k$, where $[A]_0$ is initial concentration
- (D) $t_{1/2} = 0.693k$, where $[A]_0$ is initial concentration

136. Dispersion of liquid into a gas is called

- (A) foam
- (B) aerosol
- (C) smoke
- (D) gel

137. Choose the molecule(s) with a center of symmetry

- (I) SF_6
 - (II) CO_2
 - (III) XeF_4
 - (IV) H_2O
- (A) I, II and III
(B) IV only
(C) III and IV
(D) I and IV

138. Possible microstates for a carbon atom with the configuration $1s^2 2s^2 2p^2$

- (A) 12
- (B) 6
- (C) 15
- (D) 9

139. Unit of partition function

- (A) dimensionless
- (B) s^{-1}
- (C) J
- (D) K^{-1}

140. Pick out the nuclei having spin, $I = 1$

- (I) ^1H
 - (II) ^2D
 - (III) ^{14}N
 - (IV) ^{19}F
- (A) (II) and (III)
(B) (I) only
(C) (IV) only
(D) (I) and (IV)

141. The bond order of NO

- (A) $2\frac{1}{2}$
- (B) 2
- (C) 1
- (D) 3

142. Used as sensitizer for the production of hydrogen atoms from H_2
- (A) Hg
 - (B) Ag
 - (C) Pb
 - (D) Al
143. First line in the rotational spectrum of CO is 3.842 cm^{-1} . The rotational constant is equal to
- (A) 19.21 cm^{-1}
 - (B) 0.1921 cm^{-1}
 - (C) 1.921 cm^{-1}
 - (D) 38.42 cm^{-1}
144. A solution shows absorbance $A = 1.0$. What percentage of radiation is absorbed by the sample?
- (A) 10
 - (B) 50
 - (C) 90
 - (D) 100
145. The number of radial nodes of $4d$ atomic orbital is
- (A) 0
 - (B) 1
 - (C) 2
 - (D) 3
146. For the reaction $\text{A} \rightarrow \text{P}$ the plot of concentration of P Vs time is linear passing through the origin. The order of the reaction is
- (A) 0
 - (B) 1
 - (C) 2
 - (D) -1
147. A buffer is prepared by mixing 100 ml, 0.1 M acetic acid ($\text{pK}_a = 4.76$) and 100 ml, 0.1 M sodium acetate. The pH of the solution is
- (A) 4.76
 - (B) 7.00
 - (C) 3.76
 - (D) 5.76

148. Which of the following is not an electrokinetic phenomena?
- (A) Electrophoresis
 - (B) Electro osmosis
 - (C) Streaming potential
 - (D) Donnan membrane equilibrium
149. Which of the following photochemical reaction has highest quantum yield?
- (A) $\text{H}_2 - \text{Cl}_2$
 - (B) $\text{H}_2 - \text{Br}_2$
 - (C) $\text{H}_2 - \text{I}_2$
 - (D) Decomposition of ozone
150. In Raman spectroscopy radiation is analyzed.
- (A) transmitted
 - (B) emitted
 - (C) scattered
 - (D) fluorescent

ANSWER KEY**Subject Name: 604 CHEMISTRY**

SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	D	31	B	61	B	91	A	121	C
2	B	32	C	62	D	92	B	122	B
3	D	33	A	63	C	93	D	123	A
4	B	34	A	64	B	94	B	124	C
5	B	35	B	65	A	95	D	125	A
6	C	36	C	66	C	96	D	126	B
7	A	37	B	67	B	97	D	127	B
8	D	38	C	68	B	98	B	128	C
9	B	39	A	69	D	99	A	129	B
10	D	40	D	70	A	100	A	130	A
11	C	41	A	71	D	101	A	131	B
12	B	42	B	72	B	102	B	132	C
13	B	43	C	73	B	103	A	133	B
14	C	44	A	74	B	104	A	134	B
15	B	45	D	75	A	105	A	135	A
16	D	46	A	76	D	106	D	136	B
17	C	47	C	77	A	107	D	137	A
18	B	48	A	78	B	108	D	138	C
19	B	49	B	79	D	109	A	139	A
20	C	50	D	80	B	110	D	140	A
21	B	51	B	81	D	111	B	141	A
22	B	52	C	82	B	112	A	142	A
23	D	53	A	83	A	113	A	143	C
24	B	54	D	84	A	114	A	144	C
25	D	55	C	85	D	115	B	145	B
26	B	56	C	86	B	116	D	146	A
27	B	57	A	87	A	117	A	147	A
28	D	58	D	88	C	118	A	148	D
29	A	59	A	89	B	119	A	149	A
30	B	60	C	90	D	120	B	150	C