

604 - CHEMISTRY (FINAL)

1. Firefly luminescence is due to
 - (A) phosphorescence
 - (B) fluorescence
 - (C) chemiluminescence
 - (D) presence of phosphorom
2. The absolute theory of reaction rates is based on
 - (A) kinetic theory of gases
 - (B) quantum mechanics
 - (C) chemical equilibrium
 - (D) classical mechanics
3. Measurement of multimolecular layer on surface area of adsorbent can be done using
 - (A) Freundlich adsorption isotherm
 - (B) BET adsorption isotherm
 - (C) Langmuir's adsorption isotherm
 - (D) Gibbs adsorption isotherm
4. The principal quantum number is related to the
 - (A) size and energy of the orbital
 - (B) shape of the orbital
 - (C) orientation of the orbital
 - (D) None of the above
5. The product of uncertainty in simultaneous determination of the exact position and momentum of a particle is
 - (A) less than or equal to the Planck constant
 - (B) equal to or greater than the Boltzman constant
 - (C) equal to or greater than the Planck constant
 - (D) equal to or less than the Boltzman constant

6. Which of the following is **NOT** true for a salt bridge?
- (A) It minimizes liquid junction potential
 - (B) It eliminates liquid junction potential
 - (C) It can be determined experimentally
 - (D) It depends on the ionic mobility of cation and anion
7. The conductivity of $0.001028 \text{ mol L}^{-1}$ acetic acid is $4.95 \times 10^{-5} \text{ S cm}^{-1}$. Calculate its dissociation constant if Λ_m° for acetic acid is $390.5 \text{ S cm}^2 \text{ mol}^{-1}$.
- (A) $2.78 \times 10^{-5} \text{ mol L}^{-1}$
 - (B) $1.78 \times 10^{-5} \text{ mol L}^{-1}$
 - (C) $3.78 \times 10^{-7} \text{ mol L}^{-1}$
 - (D) $1.78 \times 10^{-3} \text{ mol L}^{-1}$
8. For an aqueous solution at 25°C Debye-Huckel limiting law is given by
- (A) $\log \gamma_{\pm} = 0.509 |Z_+ Z_-| \sqrt{\mu}$
 - (B) $\log \gamma_{\pm} = 0.509 |Z_+ Z_-| \mu$
 - (C) $\log \gamma_{\pm} = -0.509 |Z_+ Z_-| \sqrt{\mu}$
 - (D) $\log \gamma_{\pm} = -0.509 |Z_+ Z_-| \mu^2$
9. Find the pH of a buffer solution containing 0.20 mole per litre CH_3COONa and 0.02 mole per litre CH_3COOH , pK_a of acetic acid is 4.76.
- (A) 5.76
 - (B) 4.76
 - (C) 7.0036
 - (D) 9.0056
10. A crystal has lattice parameter $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90^\circ$, the crystal system is
- (A) triclinic
 - (B) orthorhombic
 - (C) cubic
 - (D) tetragonal

11. Both Schottky and Frenkel defects are found in crystal.
- (A) NaCl
 - (B) AgCl
 - (C) AgBr
 - (D) FeS
12. The magnetic moments of the domains in the substance are aligned in parallel and anti-parallel directions in unequal numbers is called
- (A) ferromagnetism
 - (B) antiferromagnetism
 - (C) diamagnetism
 - (D) ferrimagnetism
13. Crystal *A* diffracts from (1 1 1) and (2 0 0) planes but not from (1 1 0) plane, while crystal *B* diffracts from (1 1 0) and (2 0 0) planes but not from (1 1 1) plane. From the above we may conclude that
- (A) *A* has FCC lattice, while *B* has BCC lattice
 - (B) *A* has BCC lattice, while *B* has FCC lattice
 - (C) *A* and *B* both has FCC lattice
 - (D) *A* and *B* both has BCC lattice
14. Calculate the Miller indices of crystal plane which cut through the crystal axes at $(2a, 3b, c)$.
- (A) (1 1 1)
 - (B) (1 0 0)
 - (C) (3 2 6)
 - (D) (2 0 0)
15. Point group of water molecule is
- (A) C_{2h}
 - (B) C_{3v}
 - (C) C_{2v}
 - (D) D_{2h}

16. Which one is the correct factor that explains the increase of rate of reaction by a catalyst?
- (A) Increase in activation energy
 - (B) Decrease in Arrhenius factor
 - (C) Increase of free energy
 - (D) Lowering of activation energy
17. Zeolites are made up of
- (A) Zinc and Aluminum
 - (B) Zirconium and Ammonium
 - (C) Silicon and Aluminium
 - (D) Zinc and Ammonium
18. For a reaction the plot of [A] against time is linear with negative slope. The order of the reaction is
- (A) Zero
 - (B) First
 - (C) Second
 - (D) Third
19. Half-life for a second order reaction is
- (A) $\frac{[A]_0}{2k}$
 - (B) $\frac{0.693}{k}$
 - (C) $\frac{1}{k[A]_0}$
 - (D) $\frac{k}{0.693}$

20. The decomposition of gaseous acetaldehyde follows second order kinetics. The half-life of this reaction is 400 second, when the initial pressure is 250 torr. What will be the rate constant and half-life respectively, if the initial pressure of acetaldehyde is 200 torr at the same temperature?
- (A) 10^5 , 500
(B) 10^{-5} , 400
(C) 10^{-5} , 500
(D) 10^{-4} , 400
21. A certain reaction proceeds in a sequence of three elementary steps, with the rate constants k_1 , k_2 and k_4 . If the rate constant is expressed as, $k_{obs} = k_2 \left(\frac{k_1}{k_4} \right)^{\frac{1}{2}}$. The activation energy of the reaction is
- (A) $\frac{1}{2} \left(\frac{E_1}{E_4} \right) + E_2$
(B) $\frac{E_1 + E_4}{2}$
(C) $\frac{E_1 - E_4}{2}$
(D) $E_2 + \frac{1}{2}(E_1 - E_4)$
22. The total number of atoms per unit cell in bcc is
- (A) 1
(B) 2
(C) 3
(D) 4
23. Arrange O_2 , O_2^+ , and O_2^- in the increasing order of stability.
- (A) $O_2^+ < O_2 < O_2^-$
(B) $O_2^+ < O_2^- < O_2$
(C) $O_2 < O_2^+ < O_2^-$
(D) $O_2^- < O_2 < O_2^+$

24. The number of radial nodes of 4f atomic orbital is
- (A) 0
 - (B) 1
 - (C) 2
 - (D) 3
25. The ground state energy of a particle confined to one dimensional box of length a is
- (A) 0
 - (B) $\frac{h^2}{8ma^2}$
 - (C) $BJ(J+1)$
 - (D) $\frac{1}{2}h\nu$
26. Which of the radiations is employed in NMR spectroscopy?
- (A) Radio frequency
 - (B) Microwave
 - (C) X-rays
 - (D) Gamma rays
27. In Raman spectroscopy radiation is analysed.
- (A) scattered
 - (B) transmitted
 - (C) reflected
 - (D) emitted
28. Cathodic process during corrosion of iron in alkaline medium is
- (A) hydrogen ion reduction
 - (B) O_2 reduction
 - (C) oxidation of Fe
 - (D) reduction of Fe^{3+}

29. In the titration of Fe^{2+} against dichromate in acid medium using diphenylamine indicator orthophosphic acid is added to
- (A) maintain constant pH
 - (B) adjust the redox potential near the indicator potential
 - (C) catalyse the reaction
 - (D) act as promoter
30. Which of the following point groups does **NOT** have inversion center?
- (A) T_d
 - (B) C_{2h}
 - (C) D_{3d}
 - (D) D_{4h}
31. EPR spectrum of CH_3^\bullet (radical) is split into lines.
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 7
32. is an example of shape selective catalyst.
- (A) ZSM-5
 - (B) Alumina
 - (C) Silica
 - (D) Carbon nanotube
33. Schrodinger wave equation for He atom does not have exact solution because of
- (A) inert nature
 - (B) e-e repulsion
 - (C) completely filled valence orbital
 - (D) two protons in the nucleus
34. The geometry around ClF_4^+ is
- (A) square planar
 - (B) square pyramidal
 - (C) see-saw
 - (D) pyramidal

35. On the basis of LCAO-MO theory, the magnetic characteristics of N_2 and N_2^+ are
- (A) both diamagnetic
 - (B) both paramagnetic
 - (C) N_2 diamagnetic and N_2^+ paramagnetic
 - (D) N_2 paramagnetic and N_2^+ diamagnetic
36. The correct classification of B_5H_9 , B_5H_{11} and B_5H_7 respectively is
- (A) closo, arachno, nido
 - (B) nido, closo, arachno
 - (C) arachno, nido, closo
 - (D) nido, arachno, closo
37. A well known naturally occurring organometallic compound is
- (A) vitamin B_{12} coenzyme
 - (B) chlorophyll
 - (C) cytochrome P-450
 - (D) myoglobin
38. The number of metal-metal bonds present in $Ir_4(CO)_{12}$ are
- (A) 4
 - (B) 6
 - (C) 5
 - (D) 8
39. The complexes $[Co(NH_3)_4(H_2O)Cl]Br_2$ and $[Co(NH_3)_4Br_2]Cl \cdot H_2O$ are examples of
- (A) ionization isomerism
 - (B) linkage isomerism
 - (C) geometrical isomerism
 - (D) optical isomerism
40. The complex with spin-only magnetic moment of ≈ 4.9 BM is
- (A) $Fe(H_2O)_6^{2+}$
 - (B) $[Fe(CN)_6]^{3-}$
 - (C) $[Fe(CN)_6]^{4-}$
 - (D) $Fe(H_2O)_6^{3+}$

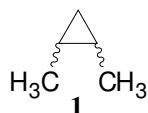
41. The number of hydroxyl (OH) groups present in phosphorous acid is
- (A) one
 - (B) two
 - (C) three
 - (D) four
42. The order of acidity of boron trihalide is
- (A) $\text{BF}_3 > \text{BCl}_3 > \text{BBr}_3$
 - (B) $\text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$
 - (C) $\text{BF}_3 > \text{BBr}_3 > \text{BCl}_3$
 - (D) $\text{BBr}_3 > \text{BF}_3 > \text{BCl}_3$
43. The first ionization potential of Mg, Al, P, and S follows the order
- (A) $\text{Mg} < \text{Al} < \text{P} < \text{S}$
 - (B) $\text{Al} < \text{Mg} < \text{P} < \text{S}$
 - (C) $\text{Al} < \text{Mg} < \text{S} < \text{P}$
 - (D) $\text{Mg} < \text{Al} < \text{S} < \text{P}$
44. On hydrolysis, aluminium carbide produces
- (A) CH_4
 - (B) C_2H_6
 - (C) C_2H_4
 - (D) C_2H_2
45. In atomic absorption spectroscopy, the atomization process utilizes
- (A) flame
 - (B) electric field
 - (C) magnetic field
 - (D) electron beam
46. The highest occupied molecular orbital of HF is
- (A) bonding
 - (B) anti-bonding
 - (C) ionic
 - (D) non-bonding

47. In the square planar crystal field, the d orbital with the highest energy is
- (A) d_{XY}
 - (B) $d_{x^2 - y^2}$
 - (C) d_z^2
 - (D) d_{YZ}
48. The **CORRECT** order of melting points of group 15 trifluorides is
- (A) $PF_3 < AsF_3 < SbF_3 < BiF_3$
 - (B) $BiF_3 < SbF_3 < PF_3 < AsF_3$
 - (C) $PF_3 < SbF_3 < AsF_3 < BiF_3$
 - (D) $BiF_3 < AsF_3 < SbF_3 < PF_3$
49. With respect to periodic properties, the **CORRECT** statement is
- (A) Electron affinity order is $F > O > Cl$
 - (B) First ionisation energy order is $Al > Mg > K$
 - (C) Atomic radius order is $N > P > As$
 - (D) Ionic radius order is $K^+ > Ca^{2+} > Mg^{2+}$
50. The **CORRECT** order of Δ_o (the octahedral crystal field splitting of d orbitals) values for the following anionic metal complexes is
- (A) $[Ir(CN)_6]^{3-} < [Rh(CN)_6]^{3-} < [RhI_6]^{3-} < [CoI_6]^{3-}$
 - (B) $[CoI_6]^{3-} < [RhI_6]^{3-} < [Rh(CN)_6]^{3-} < [Ir(CN)_6]^{3-}$
 - (C) $[CoI_6]^{3-} < [Rh(CN)_6]^{3-} < [RhI_6]^{3-} < [Ir(CN)_6]^{3-}$
 - (D) $[Ir(CN)_6]^{3-} < [CoI_6]^{3-} < [Rh(CN)_6]^{3-} < [RhI_6]^{3-}$
51. The decay modes of ^{14}C and ^{14}O are
- (A) β decay
 - (B) positron emission
 - (C) β decay and positron emission, respectively
 - (D) positron emission and β decay, respectively

52. The **CORRECT** option for the metal ion present in the active site of myoglobin, hemocyanin and vitamin B12, respectively, is
- (A) iron, iron and zinc
 - (B) molybdenum, iron and copper
 - (C) iron, copper and cobalt
 - (D) molybdenum, copper and cobalt
53. Among the following compounds, the one having the lowest boiling point is
- (A) SnCl_4
 - (B) GeCl_4
 - (C) SiCl_4
 - (D) CCl_4
54. Number of vertices in an icosahedral closo-borane is
- (A) 10
 - (B) 8
 - (C) 24
 - (D) 12
55. Among the following complex ion that would show strong Jahn-Teller distortion is
- (A) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$
 - (B) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
 - (C) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$
 - (D) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
56. The enthalpies of hydration of Ca^{2+} , Mn^{2+} and Zn^{2+}
- (A) $\text{Mn}^{2+} > \text{Ca}^{2+} > \text{Zn}^{2+}$
 - (B) $\text{Zn}^{2+} > \text{Ca}^{2+} > \text{Mn}^{2+}$
 - (C) $\text{Mn}^{2+} > \text{Zn}^{2+} > \text{Ca}^{2+}$
 - (D) $\text{Zn}^{2+} > \text{Mn}^{2+} > \text{Ca}^{2+}$

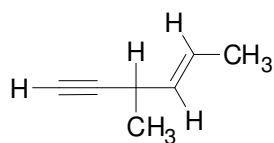
57. The number of terminal carbonyl groups present in $\text{Fe}_2(\text{CO})_9$ is
- (A) 2
 - (B) 6
 - (C) 5
 - (D) 3
58. The bond order in Be_2^+ molecule can be expected to be
- (A) 0
 - (B) 1
 - (C) 2
 - (D) 3
59. Which one of the following is a monobasic acid?
- (A) $\text{H}_4\text{P}_2\text{O}_7$
 - (B) H_3PO_4
 - (C) H_3PO_3
 - (D) H_3PO_2
60. Which one of the following has the largest energy band gap?
- (A) Germanium
 - (B) Silicon
 - (C) Tellurium
 - (D) Diamond
61. The number of possible isomers for the octahedral complex in $[\text{Co}(\text{en})\text{Cl}_2\text{Br}_2]^-$ is
- (A) 2
 - (B) 4
 - (C) 6
 - (D) 8
62. The complex which obeys the 18-electron rule
- (A) $\text{Fe}(\text{CO})_4$
 - (B) $\text{Ni}(\text{CO})_3(\text{PPh}_3)$
 - (C) $\text{Cr}(\text{CO})_5$
 - (D) $\text{Cr}(\text{C}_5\text{H}_5)_2$

63. As a ligand Cl^- is
- (A) only a sigma donor
 - (B) only a pi donor
 - (C) both a sigma donor and a pi donor
 - (D) a sigma donor and a sigma acceptor
64. Which of the following molecule have non zero dipole moment?
- (A) NF_3
 - (B) BF_3
 - (C) CO_2
 - (D) BeF_2
65. An example of a molecule with three-center two-electron band is
- (A) XeF_2
 - (B) B_2H_6
 - (C) ICl_2
 - (D) BF_4
66. Which is the strongest acid?
- (A) HClO_4
 - (B) HClO_3
 - (C) HClO_2
 - (D) HClO
67. 1,2-Dimethylcyclopropane (**1**) exhibits



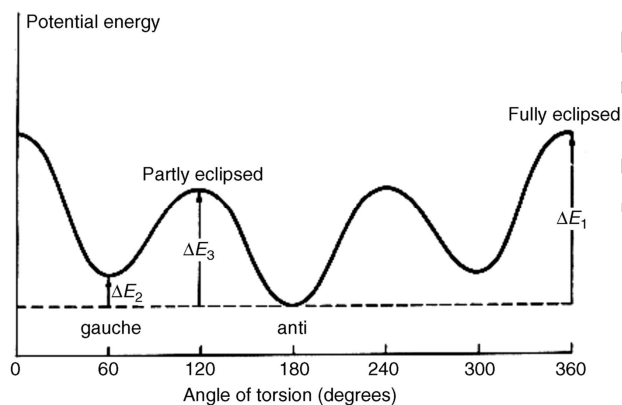
- (A) optical isomerism only
- (B) geometrical isomerism only
- (C) neither optical nor geometrical isomerism
- (D) both optical and geometrical isomerism

68. IUPAC name for the following eneyne is



- (A) (*E*)-hex-4-en-1-yne
- (B) (*E*)-hex-2-en-5-yne
- (C) (*Z*)-hex-4-en-1-yne
- (D) (*Z*)-hex-2-en-5-yne

69. The following conformational energy diagram is most likely for



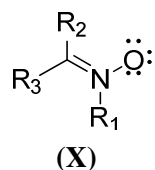
- (A) propane
- (B) ethane
- (C) cyclohexane
- (D) *n*-butane

70. The following bond cleavage represented by a double headed arrow indicates



- (A) homolytic cleavage with X leaving as a radical
- (B) heterolytic cleavage with X leaving without the electron pair
- (C) heterolytic cleavage with departure of X with a pair of electrons
- (D) homolytic cleavage with X leaving as a radical anion

71. Imine oxides (also known as nitrones), are stable, nonpolar compounds represented by the following Lewis structure with charges, if any, positioned appropriately. Formal charges on nitrogen and oxygen in (X) are

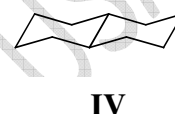
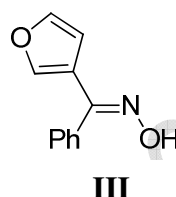
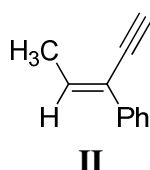
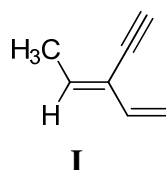


- (A) +1 on oxygen and zero on nitrogen
(B) +1 on oxygen and -1 on nitrogen
(C) since the compound is nonpolar, zero on both nitrogen and oxygen
(D) +1 on nitrogen and -1 on oxygen
72. Pick the correct statement on the geometry of reactive intermediates such as carbocations, carbanions and carbon centered radicals
- (A) all carbocations and carbon centered radicals are planar
(B) all carbanions and carbon centered radicals are planar
(C) all carbanions and carbon centered radicals are pyramidal
(D) all carbocations, resonance stabilized carbanions and resonance stabilized carbon centered radicals are planar
73. Which among the following is **NOT** a typical reaction of carbocations having at least one β -hydrogen?
- (A) Elimination of a proton to give an olefin
(B) Addition to a double bond to give another carbocation
(C) Rearrangement to give another carbocation intermediate
(D) Insertion to double bonds to give cyclopropanes
74. Reaction of propane with bromine in the presence of light gives a mixture of 2-bromopropane (97%) and 1-bromopropane (3%). Based on this result, estimate the relative reactivity of methylene (CH_2) and methyl (CH_3) hydrogen towards free radical substitution by Br.
- (A) 97:3
(B) 97:1
(C) 97:6
(D) 97:9

75. Assuming that all cycloalkanes are planar molecules and hence regular polyhedrons, according to Baeyer's strain theory, which among the following cycloalkanes should exhibit the lowest heat of combustion per CH_2 ?

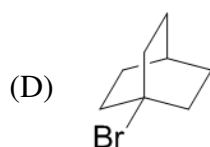
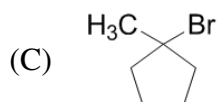
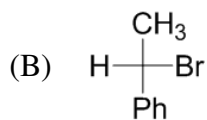
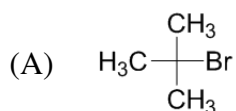
- (A) Cyclopropane
- (B) Cyclobutane
- (C) Cyclopentane
- (D) Cyclohexane

76. Which among the following compound/compounds has/have Z-configuration?

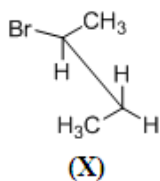


- (A) **I** only
 - (B) **I** and **IV**
 - (C) **II** and **III**
 - (D) None of the above
77. Pick the statement that is **NOT** true for the eight D-aldohexoses (D-allose, D-altrose, D-glucose, D-mannose, D-gulose, D-iodose, D-galactose and D-talose).
- (A) All of them give a 5:1 mixture of formic acid and formaldehyde on oxidation with periodic acid
 - (B) C-5 carbon in all the eight of them has *R*-configuration
 - (C) In solution, all of them exist as an equilibrium mixture of α and β -anomers
 - (D) On reaction with phenylhydrazine, the eight aldohexoses give eight isomeric osazones

78. Which among the following compounds is *least likely* to undergo E1 elimination?

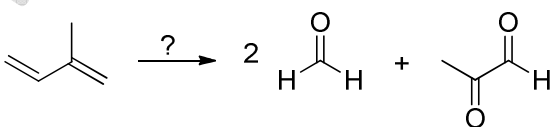


79. Major Saytzeff's E2 elimination product of (*S*)-2-bromobutane (**X**) is



(D) a 1:1 mixture of *E* and *Z*-isomers of but-2-ene

80. Suggest suitable reagents to bring about the following transformation.



(A) Alkaline KMnO_4

(B) O_3 followed by dimethyl sulfide

(C) Dilute sulfuric acid in the presence of mercuric sulfate

(D) Periodic acid

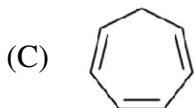
81. Alkynes can be hydrated (addition of water) by treatment with dilute sulfuric acid in the presence of mercuric sulfate. Hydration products of all terminal alkynes sharing the molecular formula C_nH_{2n-2} will

- (A) reduce Fehling solution
- (B) restore the color of Schiff's reagent
- (C) undergo ozonolysis to give formaldehyde as one of the major products
- (D) give a yellow precipitate on treatment with iodine in the presence of base

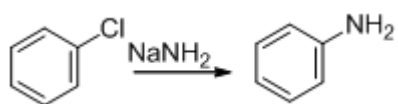
82. Pick the correct statement.

- (A) Nature of leaving group is equally important in controlling both SN1 and SN2 reaction rates
- (B) Nature of nucleophile is equally important in controlling both SN1 and SN2 reaction rates
- (C) Nature of leaving group is more important in controlling SN2 reaction rates while nature of nucleophile is more important in controlling SN1 reaction rates
- (D) Good leaving groups accelerate SN2 reaction rates while SN1 reaction rates are not affected by the nature of the leaving group

83. Which among the following compounds has the lowest pK_a ?



84. Intermediate involved in the following substitution reaction is



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

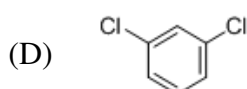
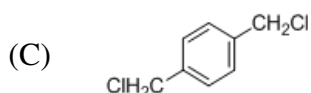
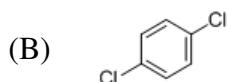
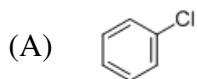
85. In aromatic electrophilic substitution reactions proceeding via the arenium ion intermediates (assuming kinetic control)

- (A) all *+I* and *+M* groups are *ortho-para* orienting and activating
- (B) all *+I* and *+M* are *ortho-para* orienting and deactivating
- (C) all *+I* groups are *ortho-para* orienting and activating while *+M* groups, though *ortho-para* orienting can be either activating or deactivating groups
- (D) all *+M* groups are *ortho-para* orienting and activating while some *+I* groups, though *ortho-para* orienting can be either activating or deactivating groups

86. A colorless liquid, boiling at 80 °C tested negative for halogens, nitrogen and sulphur. It gave a yellow precipitate with Borche's reagent, but a negative test with Tollen's reagent. It also gave a positive iodoform test. The compound was refluxed with a 1:1 mixture of concentrated nitric acid and sulfuric acid and the reaction mixture on pouring into ice cold water remained colorless. The compound, most probably is

- (A) an aliphatic methylketone
- (B) an aromatic methyl ketone
- (C) a cyclic ketone
- (D) an ester

87. In Lassaigne's test, a colorless solid tested positive for chlorine and negative for both nitrogen and sulfur. It gave a negative test with both aqueous and alcoholic silver nitrate solutions and gave a single mononitration product. Which among the following is the most likely structure for this compound?



88. Borche's reagent is prepared by

- (A) dissolving boric acid in dilute sulfuric acid
- (B) dissolving disodium hydrogen phosphate in a 1:1 mixture of water and ethanol
- (C) dissolving 2,4-dinitrophenylhydrazine in methanol containing a small amount of concentrated sulfuric acid
- (D) dissolving silver nitrate in 95% ethanol

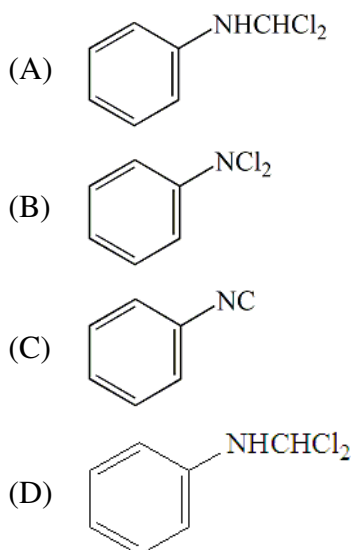
89. Which among the following saccharides will give a bright red precipitate with Fehling solution?

- (A) All monosaccharides
- (B) All disaccharides
- (C) All mono and polysaccharides
- (D) Polysaccharides only

90. Which among the following is **NOT** a suitable method for the preparation of benzylamine ($C_6H_5CH_2NH_2$)?

- (A) Reaction of ammonium formate with benzaldehyde at temperature above $100^\circ C$
- (B) Hoffmann bromamide reaction of benzamide
- (C) Gabriel phthalimide synthesis starting from benzyl chloride
- (D) Reduction of benzonitrile using lithium aluminum hydride

91. Structure of the foul smelling compound formed when aniline is treated with chloroform in the presence of sodium hydroxide is



92. Reaction of benzene diazonium chloride with β -naphthol to give the corresponding azo dye is an example for

- (A) aromatic nucleophilic substitution proceeding through bimolecular displacement mechanism
(B) S_N1 substitution on an aromatic ring
(C) aromatic nucleophilic substitution proceeding through benzyne intermediate
(D) aromatic electrophilic substitution reaction

93. In qualitative analysis, Schotten-Baumann reaction is employed for preparing **crystalline** derivatives for

- (A) aromatic tertiary amines
(B) polycyclic aromatic hydrocarbons
(C) primary and secondary aromatic amines
(D) tertiary alcohols and phenols

94. Arndt-Eisert homologation reaction is particularly useful for the synthesis of

- (A) 1,2-dicarboxylic acids from carboxylic acids
(B) β -aminoacids from α -aminoacids
(C) mixed anhydrides from a binary mixture of carboxylic acids
(D) 1,3-dicarbonyl compounds from carbonyl compounds

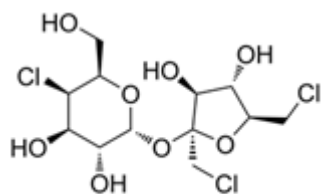
95. Which among the following name reactions is suitable for the preparation of thiophene?

- (A) Paal-Knorr synthesis
- (B) Hantzsch synthesis
- (C) Skraup synthesis
- (D) Friedländer synthesis

96. [3,3] Sigmatropic shift is **NOT** involved in

- (A) Claisen rearrangement
- (B) Fries rearrangement
- (C) Fischer indole synthesis
- (D) Cope rearrangement

97. Pick the statement that is correct for the following molecule.

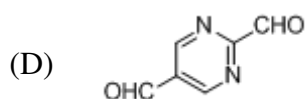
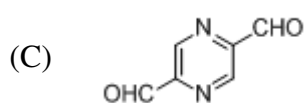
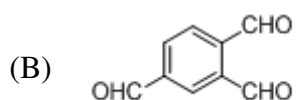
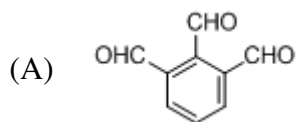


- (A) It gives a brown precipitate on boiling with Benedict's reagent
- (B) It is hydrolysed with dilute HCl to give a 1:1 mixture of glucose and sucrose
- (C) It is a reagent for the spot test for group III cations
- (D) It is an artificial sweetener

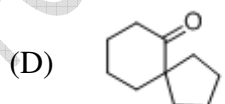
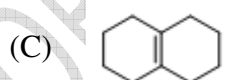
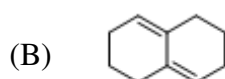
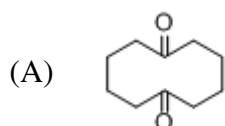
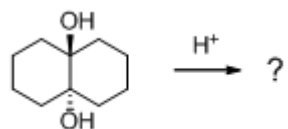
98. Which among the following is an ω -3 fatty acid?

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

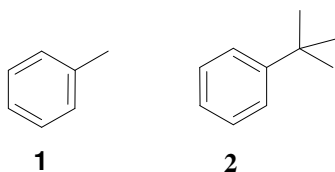
99. An aromatic compound exhibits two signals, both sharp singlets of equal intensity at δ 10.24 and 9.31 ppm. In its IR spectrum, a strong peak is observed at 1730 cm^{-1} and it restored the color of Schiff's reagent. Which among the following structures agrees best with these data?



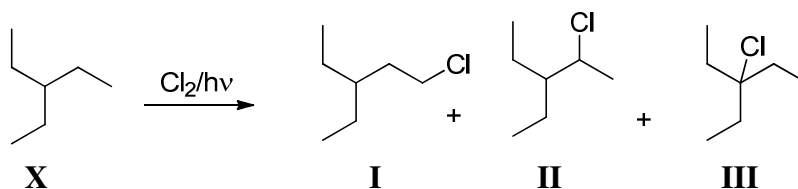
100. Predict the major product formed in the following reaction.



101. Toluene (**1**) is more reactive than *t*-butylbenzene (**2**) towards aromatic electrophilic substitution due to

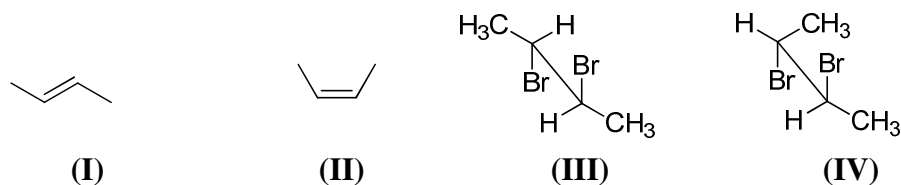


- (A) inductive effects
(B) π -conjugation
(C) hyperconjugation
(D) steric factors
102. Pick the correct statement.
- (A) Both carbocations and carbanions are electrophilic in nature
(B) Both carbocations and carbanions are nucleophilic in nature
(C) Carbocations are electrophilic while carbanions are nucleophilic in nature
(D) Carbocations are nucleophilic while carbanions are electrophilic in nature
103. Selective halogenation of isopentane (2-methylbutane, C_5H_{12}) at the 2-position is most effective (that is, high yield with minimal side products) with
- (A) fluorine
(B) chlorine
(C) bromine
(D) iodine
104. Hydrocarbons are chlorinated using chlorine gas in the presence of light. From experimentation, it has been determined that the relative rates of chlorination to primary (CH_3), secondary (CH_2), and tertiary (CH) positions in hydrocarbons are 1, 3.8, and 5 respectively. Based on this, predict the **major** monochlorination product generated from 2-ethylpentane (**X**) in the following reaction.



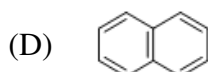
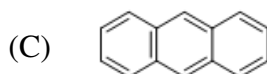
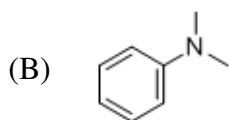
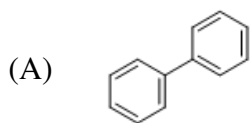
- (A) **I**
(B) **II**
(C) **III**
(D) All the three products are formed in approximately equal ($\pm 2\%$) amounts

105. Pick the correct statement on the reaction of (*E*)-but-2-ene (**I**) and (*Z*)-but-2-ene (**II**) with Br₂.



- (A) both **(I)** and **(II)** will give *meso*-2,3-dibromobutane **(III)**
(B) both **(I)** and **(II)** will give the *d,l*-pair of 2,3-dibromobutane **(IV)**
(C) **(I)** will give *meso*-2,3-dibromobutane **(III)** while **(II)** will give the *d,l*-pair **(IV)**
(D) **(II)** will give *meso*-2,3-dibromobutane **(III)** while **(I)** will give the *d,l*-pair **(IV)**
106. Pick the statement that is true for S_N1 substitution reactions on a chiral carbon.
- (A) proceeds with retention of configuration
(B) proceeds with racemization
(C) proceeds with inversion of configuration
(D) stereochemical outcome depends on the amount of nucleophile used in the reaction
107. Which among the following reactions is **NOT** suitable for the preparation of a primary alcohol?
- (A) Reaction of isopropylmagnesium bromide with oxirane
(B) Reaction of propylmagnesium bromide with 2,2-dimethyloxirane
(C) Reaction of isopropylmagnesium bromide with formaldehyde
(D) Reaction of propylmagnesium bromide with formaldehyde
108. Which among the following compounds can be converted to benzene in one step?
- (A) Nitrobenzene
(B) Toluene
(C) Benzaldehyde
(D) Phenol
109. Which among the following is **NOT** a pericyclic reaction?
- (A) Dieckmann cyclization
(B) Electrocyclic ring closure
(C) Sigmatropic rearrangements
(D) Cycloaddition

110. Which among the following compounds fails to give a crystalline charge transfer complex with 2,4,6-trinitrophenol?



111. An unknown compound burned with a sooty flame. When reacted with NaNO_2 and concentrated H_2SO_4 it gave a deep blue color which changed to red on dilution with water. The original blue color was regenerated by treatment with potassium hydroxide solution. The unknown compound most probably is

- (A) an aromatic primary amine
- (B) a phenol
- (C) an aromatic nitro compound
- (D) an aliphatic dicarboxylic acid

112. Reaction of diazomethane with acetic acid will give

- (A) methyl acetate
- (B) methyl diazoacetate
- (C) propionic acid
- (D) ethanol

113. Ethyl acetoacetate is prepared by

- (A) condensation of acetaldehyde with ethyl acetate
- (B) acylation of ethyl acetate using acetyl chloride in the presence of anhydrous aluminum chloride
- (C) reaction of ethyl acetate with sodium ethoxide in ethanol
- (D) treatment of diethyl malonate with methyl magnesium bromide under controlled conditions

114. Repeating units and their connectivity in the most abundant naturally occurring organic polymer are
- (A) $\beta(1\rightarrow4)$ linked glucose units
 - (B) $\alpha(1\rightarrow4)$ linked glucose units
 - (C) aminoacids linked through peptide linkages
 - (D) nucleosides connected through phosphate linkages
115. Which among the following is a triphenylmethane dye?
- (A) methyl orange
 - (B) fluorescein
 - (C) rosaniline
 - (D) alizarin
116. *N,N'*-Dicyclohexylcarbodiimide (DCC) finds application in peptide chemistry as a reagent for
- (A) *N*-terminal analysis
 - (B) *C*-terminal analysis
 - (C) *C*-activation in peptide synthesis
 - (D) *N*-protection in peptide synthesis
117. The process by which mRNA directs protein synthesis with the assistance of tRNA is called
- (A) translation
 - (B) transcription
 - (C) reverse transcription
 - (D) replication
118. The number of IR active vibrational normal modes of CO₂ is
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 6

119. The **CORRECT** statement regarding the observed magnetic properties of NO, O₂, B₂, and C₂ in their ground state is
- (A) NO, B₂, and C₂ are paramagnetic
 - (B) B₂, O₂ and NO are paramagnetic
 - (C) O₂, C₂ and NO are paramagnetic
 - (D) O₂, B₂ and C₂ are paramagnetic
120. In the structure of P₄O₁₀, the number of P-O-P bond(s) is
- (A) 4
 - (B) 6
 - (C) 7
 - (D) 8
121. The number of S-S bond in H₂S₅O₆ is
- (A) 2
 - (B) 5
 - (C) 4
 - (D) 3
122. The complex with inverse spinel structure is
- (A) Co₃O₄
 - (B) MgAlO₄
 - (C) Fe₃O₄
 - (D) Mn₃O₄
123. The ground state term of [Ni(H₂O)₆]²⁺ is
- (A) ³T_{1g}
 - (B) ³A_{2g}
 - (C) ³T_{2g}
 - (D) ⁴T_{1g}

124. Which of the following do **NOT** act as chelating agent?
- (A) $\text{HC}(\text{CH}_2\text{CH}_2\text{NH}_2)_3$
 - (B) $\text{CH}_3\text{NHCH}_2\text{CH}_2\text{CH}_3$
 - (C) $\text{N}(\text{CH}_2\text{CH}_2\text{NH}_2)_3$
 - (D) $\text{H}_2\text{NCH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
125. An examples of nido-borane from the following is
- (A) B_4H_{10}
 - (B) B_6H_{10}
 - (C) B_6H_{12}
 - (D) B_8H_{14}
126. The geometries of $\text{Ni}(\text{CO})_4$ and $[\text{NiCl}_4]^{2-}$ respectively are
- (A) tetrahedral and square planer
 - (B) square planer and tetrahedral
 - (C) tetrahedral and tetrahedral
 - (D) square planer and square planer
127. The heteronuclear diatomic molecule that is isoelectronic to HCN is
- (A) NO
 - (B) CO
 - (C) BO
 - (D) SO
128. Which one of the following free ions has the lowest magnetic moment?
- (A) Ce^{3+}
 - (B) Nd^{3+}
 - (C) Sm^{3+}
 - (D) Gd^{3+}

129. The crystal field stabilization energy and the spin only magnetic moment of $[\text{CoF}_6]^{4-}$ are respectively
- (A) $0.4\Delta_o$ and 4.9 BM
 - (B) $0.8\Delta_o$ and 3.8 BM
 - (C) $1.8\Delta_o$ and 1.7 BM
 - (D) $2.4\Delta_o$ and 0 BM
130. Which of the following has maximum number of lone pairs associated with Xe?
- (A) XeF_2
 - (B) XeO_3
 - (C) XeF_4
 - (D) XeF_6
131. An element with atomic number 88 belongs to
- (A) Group 12
 - (B) Group 2
 - (C) Group 8
 - (D) Group 10
132. The number of precipitable halide ions in $[\text{Pt}(\text{NH}_3)\text{Cl}_2\text{Br}]\text{Cl}$ is
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 1
133. Which of the following is amphoteric oxide?
- (A) CO
 - (B) N_2O
 - (C) Al_2O_3
 - (D) P_4O_{10}

134. Which of the following is an ionic hydride?
- (A) PH_3
 - (B) H_2S
 - (C) HI
 - (D) KH
135. Which of the following is an Eigen function of $\frac{d}{dx}$?
- (A) $\sin kx$
 - (B) $\cos kx$
 - (C) e^{ikx}
 - (D) $\log x$
136. Which of the following molecules is microwave active?
- (A) CO_2
 - (B) CH_4
 - (C) C_6H_6
 - (D) COS
137. The absorbance of a solution is 1.0. What percent of radiation is absorbed by the sample?
- (A) 100%
 - (B) 90%
 - (C) 50%
 - (D) 10%
138. Which of the following nuclei are NMR **INACTIVE**?
- (A) ^2H
 - (B) ^{17}O
 - (C) ^{23}Na
 - (D) ^{12}C

139. $S_3^3 = ?$
- (A) σ
 - (B) E
 - (C) C_3^2
 - (D) i
140. \bar{C}_v for CO_2 using equipartition principle is
- (A) $\frac{13}{2}R$
 - (B) $\frac{7}{2}R$
 - (C) $\frac{5}{2}R$
 - (D) $\frac{3}{2}R$
141. Arrange translational, rotational, vibrational and electronic partition functions in the increasing order of magnitudes.
- (A) $q_{\text{Tra}} < q_{\text{Rot}} < q_{\text{Vib}} < q_{\text{El}}$
 - (B) $q_{\text{Tra}} > q_{\text{Rot}} > q_{\text{Vib}} > q_{\text{El}}$
 - (C) $q_{\text{Tra}} > q_{\text{Vib}} > q_{\text{Rot}} > q_{\text{El}}$
 - (D) $q_{\text{Tra}} > q_{\text{El}} > q_{\text{Vib}} > q_{\text{Rot}}$
142. Which of the following statements is **NOT** true for Boltzmann exponential law?
- (A) Maximum population of molecules is always in the ground state
 - (B) As temperature increases population in the higher energy levels increases
 - (C) As energy increases population increases
 - (D) Intensity of spectral lines can be understood
143. Which among the following has maximum magnitude?
- (A) RMS velocity
 - (B) Mean velocity
 - (C) Most probable velocity
 - (D) Average value of the component of velocity in one direction

144. Which of the following statements is **TRUE** about viscosity?
- (A) Viscosity of liquids and gases decreases with temperature
 - (B) Viscosity of gases and liquids increases with temperature
 - (C) Viscosity of gases increases with temperature
 - (D) Viscosity of liquids increases with temperature
145. When 800 mA of current is passed through an aqueous solution of CuSO_4 for 20 minutes
- (A) 31.5 mg of Cu is deposited at cathode
 - (B) 63.5 mg of Cu is deposited at cathode
 - (C) 800 mg of Cu is deposited at cathode
 - (D) 400 mg of Cu is deposited at cathode
146. The efficiency of an ideal Carnot engine is
- (A) 100%
 - (B) less than 100%
 - (C) greater than 100%
 - (D) 50%
147. Chemical potential is defined as
- (A) $\left(\frac{\partial A}{\partial n_i}\right)_{P,T,n_j}$
 - (B) $\left(\frac{\partial G}{\partial n_i}\right)_{V,T,n_j}$
 - (C) $\left(\frac{\partial A}{\partial n_i}\right)_{V,T,n_j}$
 - (D) $\left(\frac{\partial u}{\partial n_i}\right)_{P,T,n_j}$
148. A surface catalysed unimolecular gas phase reaction follows
- (A) first order kinetics at all pressure
 - (B) zero order kinetics at all pressure
 - (C) first order kinetics at low pressure and zero order kinetics at higher pressure
 - (D) zero order kinetics at low pressure and first order kinetics at high pressure

149. Which of the following is **NOT** an electrokinetic phenomena?

- (A) Electrophoresis
- (B) Electro osmosis
- (C) Streaming potential
- (D) Donnan membrane equilibrium

150. Which of the following is related to over voltage?

- (A) Nernst equation
- (B) Tafel equation
- (C) Debye-Huckel onsager equation
- (D) Faradays laws

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FINAL ANSWER KEY**Subject Name: 604 CHEMISTRY**

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