TEST FOR POST GRADUATE PROGRAMMES

CHEMISTRY

Time: 2 Hours

Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.

2. Write your Roll Number in the space provided on the top of **this page**.

3. Also write your Roll Number, Test Code, and Test Subject in the columns provided for the same on the **Answer Sheet**. Darken the appropriate bubbles with a **Ball Point Pen.**

4. The paper consists of 150 objective type questions. All questions carry equal marks.

5. Each question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble corresponding to the correct response fully by a **Ball Point Pen** as indicated in the example shown on the Answer Sheet.

6. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.

7. Space for rough work is provided at the end of this Test Booklet.

8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet.

9. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happening, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.

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CHEMISTRY

1. The selection rules for hydrogenic atoms are

    (A) $\Delta l = \pm 1$ $\Delta m_1 = 0, \pm 1$ (B) $\Delta l = \pm 1$ $\Delta m_1 = \pm 1\frac{1}{2}$

    (C) $\Delta l = 0$ $\Delta m_1 = \pm \frac{1}{2}$ (D) $\Delta l = \pm 1$ $\Delta m_1 = -\frac{1}{2}$

2. The orbitals to which a 4s electron make spectroscopic transition

    (A)   nd orbital only   (B)   np orbital only
    (C)   ns orbital only   (D)   nf orbital only

3. Pick out the fermions from the following particles.
   (a) Electron   (b) Proton (c) Neutron   (d) Photon

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

4. Shape of hybrid orbital for sp^3d hybridisation

    (A)   Octahedral   (B)   Tetrahedral
    (C)   Trigonal bipyramidal   (D)   Linear

5. The bond order of O_2

    (A)   1   (B)   0
    (C)   2   (D)   3

6. Pick out the molecules that do not have rotational spectra
   CH_4, CO_2, HCl, H_2, NH_3

    (A) H_2 and HCl (B) HCl and NH_3
    (C) CH_4, CO_2 and H_2 (D) NH_3 and CH_4

7. The number of normal modes of vibration in ethyne $(HC \equiv CH)$ and a protein molecule of 4000 atoms are

   (A) 7 and 11,994   (B) 6 and 11,995
   (C) 12 and 12,000   (D) 7 and 11,995

8. The transfer of 100 kJ of energy as a heat to a large mass of water at $100^\circ C$ results in change in entropy of

   (A) 366 J K^{-1} (B) 268 J K^{-1}
   (C) 312 J K^{-1} (D) 26.8 J K^{-1}

9. Which of the following statements is not true?

   (A) The triple point marks the lowest temperature at which the liquid can exist.
   (B) Three phase boundaries meet at triple point.
   (C) The triple point of a pure substance is characteristic, unchangeable physical property of the substance.
   (D) For water, the triple point lies at 373 K.

10. The thermodynamic criterion for spontaneous change at constant temperature and pressure is

    (A) $\Delta G < 0$ (B) $\Delta G > 0$
    (C) $\Delta G = 0$ (D) None of the above

11. The rate of formation of NH_3 in the reaction, $N_{2(g)} + 3\,H_{2(g)} \rightarrow 2\,NH_{3(g)}$ is 0.6 m mol dm^{-3} s^{-1} under a certain set of conditions. The rate of consumption of H_2 is equal to

    (A) 0.6 mmol dm^{-3} s^{-4} (B) 0.9 mmol dm^{-3} s^{-1}
    (C) 0.3 mmol dm^{-3} s^{-1} (D) 0.12 mmol dm^{-3} s^{-1}

12. Which of the following concepts is not true?

   (A) Diffusion takes place in a random walk
   (B) Enzymes are homogeneous, biological catalysts
   (C) The rate-determining step is the slow step in a reaction mechanism that controls the rate of the overall reaction
   (D) Catalysts are substances that accelerate reactions and undergo net chemical change

13. The number of orbitals in a shell with $n = 5$ (n-principal quantum number) are

   (A) 5   (B) 10
   (C) 25   (D) 20

14. Match the following:

Colour	(Wavelength, λ / nm)
I Green	(i) 420
II Red	(ii) 620
III Orange	(iii) 530
IV Violet	(iv) 700

   (A) I-iii, II-iv, III-ii, IV-i   (B) I-iv, II-iii, III-ii, IV-i
   (C) I-ii, II-iii, III-iv, IV-i   (D) I-i, II-ii, III-iv, IV-iii

15. E (identity) is equal to

   (A) C_3^+ (B) $C_3^- C_3^+$
   (C) $C_3^+ C_3^+$ (D) $\sigma_v C_3^+$

16. An example of D_{6h} point group is this molecule

   (A) water   (B) meso-tartaric acid
   (C) ammonia   (D) benzene

17. Fourier synthesis means

    (A) a map of interatomic vectors obtained by Fourier analysis of diffraction intensities
    (B) the construction of the electron density distribution from structure factor
    (C) systematic absence
    (D) measuring the structure factor

18. The dipolemoment of HCl is 3.697×10^{-30} C.m and the bond length is 127.5 pm. The net charges on the H and Cl atoms are

    (A) 1.81 e   (B) 18.1 e
    (C) 0.181 e   (D) 0.181×10^{-10} e

19. Choose the correct statements

    (i) s orbitals are spherically symmetric
    (ii) A harmonic oscillator obeys Hooke's law
    (iii) Spin quantum number for an electron, $s = 1$
    (iv) Planck's constant, $h = 6.626 \times 10^{-34}$ J s

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

20. Which of the following statements is not true?

    (A) Bosons are particles with half integral spin
    (B) Bosons are particles with integral spin
    (C) Bosons are particles with zero spin
    (D) Bosons are the forces that bind fermions together

21. How many distinct ways are there of assigning two electrons to the nd orbitals ?

    (A) 35   (B) 45
    (C) 25   (D) 15

22. The rate constant k_1 for the reaction, $H^+(aq) + OH^-(aq) \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} H_2O(l)$ is 1.4×10^{11} dm³ mol⁻¹ s⁻¹. The initial conditions are, $\left[H^+\right]_0 = \left[OH^-\right]_0 = 0.10$ mol dm⁻³. The half-life of the reaction is

    (A) 0.71 s   (B) 7.1×10^{-8} s

    (C) 0.71×10^{-11} s   (D) 7.1×10^{-11} s

23. Match the following:

List I	List II
I Molecular partition function	(i) $k_c = k_1/k_{-1}$
II $k = Ae^{-E_a/RT}$	(ii) $q = \sum g_i e^{-\beta e_i}$
III Boltzmann constant	(iii) Arrhenius equation
IV Principle of detailed balance	(iv) gas constant per molecule

    (A) I-iii, II-iv, III-ii, IV-i   (B) I-ii, II-iii, III-iv, IV-i

   (C) I-iv, II-iii, III-ii, IV-i   (D) I-i, II-ii, III-iv, IV-iii

24. Choose the correct statements

    (i)   Glass electrode is sensitive to hydrogen ion activity

    (ii)   Cathode is an electrode at which oxidation occurs

    (iii) Charge density = charge in a small region/volume of the region

    (iv) The geometric mean of x and y is $(xy)^{1/2}$

    (A) (i) and (ii)   (B) (i), (iii) and (iv)

    (C) (i), (ii) and (iii)   (D) (i) and (iv)

25. Variance is

    (A) the square of the standard deviation

    (B) the square root of the standard deviation

    (C) equal to standard deviation

    (D) None of the above
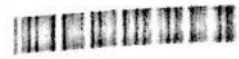
26. Arrange the following ions in the increasing order of ionic mobilities in water at 298 K:

H^+, OH^-, K^+, F^-

   (A) $F^- < K^+ < OH^- < H^+$
   (B) $F^- < OH^- < K^+ < H^-$
   (C) $K^+ < H^+ < F^- < OH^-$
   (D) $F^- < H^+ < OH^- < K^-$

27. The following data is given (p-probability)

x	p(x)
1	0.20
3	0.25
4	0.55

   The average value of x is equal to

   (A) $<x> = 3.15$
   (B) $<x> = 2.6$
   (C) $<x> = 0.33$
   (D) $<x> = 0.12$

28. Identify a typical light source for far-IR radiation

   (A) Mercury arc inside a quartz envelope
   (B) Globar
   (C) Tungsten filament
   (D) Deuterium lamp

29. Choose the correct statements

   (i) $ds < 0$ (spontaneous process in an isolated system)
   (ii) $ds = 0$ (reversible process in an isolated system)
   (iii) The entropy is tending to a maximum
   (iv) Entropy is a state function.

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

30. Asymmetric stretching vibration of CO_2

    (A) Raman inactive and IR active
    (B) Both Raman and IR active
    (C) Raman active and IR inactive
    (D) Both Raman and IR inactive

31. Match the following:

List I	List II
I Ruby Laser	(i) $M_gAl_2O_4$
II Spinel	(ii) Sodium aluminium silicate
III Zeolote	(iii) $LiNbO_3$
IV Ferroelectrics	(iv) Al_2O_3 doped with a small amount of Cr^{3+}

    (A) I-iv, II-i, III-ii, IV-iii
    (B) I-ii, II-iii, III-iv, IV-i
    (C) I-iv, II-iii, III-ii, IV-i
    (D) I-i, II-ii, III-iv, IV-iii

32. These elements exhibit ferro - or antiferromagnetism.
(i) Cr (ii) Mn (iii) Mg (iv) Co

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

33. Niegler-Natta catalyst

    (A) $AlEt_3$
    (B) $AlEt_2Cl$
    (C) $AlEt_3$ or $AlEt_2Cl$ in combination with titanium chlorides
    (D) $Al(NO_3)_2$

34. Number of significant figures in 0.0405

    (A) 4
    (B) 3
    (C) 5
    (D) 1

35. Phase space is

    (A) six dimensional
    (B) three dimensional
    (C) two dimensional
    (D) one dimensional

36. The dipole moment of SO_3 (trigonal planar) is

   (A)   0   (B)   1.03 D
   (C)   4.64 D   (D)   0.12 d

37. Number of lines in the e.s.r spectrum of the following radicals $[CF_2H]$, $[^{13}CF_2H]$ and $[CF_2D]$ are,

   (A)   6, 12, 9   (B)   8, 12, 10
   (C)   9, 12, 6   (D)   12, 6, 9

38. Which of the following statements is not true?

   (A)   A catalyst does not affect the equilibrium constant
   (B)   Thermodynamics equilibrium constant is expressed in terms of activities
   (C)   Partially miscible liquids are liquids that mix in all proportions at all temperatures
   (D)   An eutectic is the mixture with the lowest melting point

39. Match the following:

   List I   List II

   I   Bohr frequency condition   (i)   hv/k
   II   Debye temperature   (ii) $\Delta E = hv$
   III Linear momentum   (iii) $\Omega\Psi = \omega\Psi$
   IV   Eigen value equation   (iv) h/λ

   (A)   I-ii, II-i, III-iv, IV-iii   (B)   I-ii, II-iii, III-iv, IV-i
   (C)   I-iv, II-iii, III-ii, IV-i   (D)   I-i, II-ii, III-iv, IV-iii

40. Linear momentum of photon of wavelength 350 nm is equal to

   (A) 0.189×10^{27} kg m s^{-1} (B) 1.189×10^{-27} kg m s^{-1}
   (C) 1.89×10^{-26} kg m s^{-1} (D) 1.89×10^{-28} kg m s^{-1}

41. f is an even function of x, if $f(x)$ satisfies

    (A) $f(-x) = f(x)$ (B) $f(-x) = 0$

    (C) $f(x) = 1$ (D) $f(x) = f(x)^2$

42. The entropy change in the surroundings when 1.0 mol H_2O (l) is formed from its elements under standard conditions at 298 K $\left(\Delta H^\circ = 286 \text{ kJ}\right)$ is

    (A) 960 J K^{-1} (B) 96 J K^{-1}

    (C) 960 J K   (D) 480 J K^{-1}

43. The number average molecular weight of the polymer, M_n is given by the equation
(where n_i is the number of molecules having molecular weight M_i)

    (A) $M_n = \sum n_i m_i / \sum n_i$ (B) $M_n = \sum n_i m_i$

    (C) $M_n = \sum n_i m_i / 1 + \sum n_i$ (D) $M_n = \left(\sum n_i m_i / \sum n_i\right) + 1$

44. Number of space groups in triclinic system is

    (A) 2   (B) 1

    (C) 0   (D) 6

45. First line in the rotational spectrum of CO is 3.842 cm^{-1}. The rotational constant is

    (A) 11.526 cm^{-1} (B) 7.684 cm^{-1}

    (C) 1.921 cm^{-1} (D) 19.21 cm^{-1}

46. Pick out the metals showing strong activity towards adsorbing gases.
Fe, V, Na, Mg, Cr, Li

    (A) Fe, V, Cr   (B) Na, Mg

    (C) Mg, Li   (D) Na, Li

47. Match the following:

Reaction		Catalyst	
I.	$(C_2H_5)_2 O$ pyrolysis	(i)	Pt
II.	Hydrogenation of oils	(ii)	W
III.	$2 NH_3 \rightarrow N_2 + 3 H_2$	(iii)	Ni
IV.	$2 HI \rightarrow H_2 + I_2$	(iv)	$I_2(g)$

(A) I-iv, II-iii, III-ii, IV-i   (B) I-ii, II-iii, III-iv, IV-i

(C) I-ii, II-i, III-iv, IV-iii   (D) I-i, II-ii, III-iv, IV-iii

48. Which of the following statements is not true?

(A) H_2O molecule has two mirror planes

(B) A regular octahedron has a center of inversion

(C) An atomic orbital is a one-electron wave function for an electron in an atom

(D) The stronger the perturbation, the smaller the lowering of the ground-state energy

49. Choose the IR inactive molecule

(A) CO_2 (B) N_2

(C) C_6H_6 (D) OCS

50. Match the following:

λ		Spectroscopy	
I.	10 m – 1 cm	(i)	Rotational
II.	1 cm – 100 μm	(ii)	UV-vis
III.	100 μm – 1 μm	(iii)	IR
IV	1 μm – 10 nm	(iv)	nmr

(A) I-iv, II-i, III-iii, IV-ii   (B) I-i, II-iv, III-iii, IV-ii

(C) I-i, II-ii, III-iii, IV-iv   (D) I-ii, II-iii, III-iv, IV-i

51. Pyrrole on treatment with HNO_3/AcOH at low temperature gives

   (A) 2-acetyl pyrrole   (B) 2-nitro pyrrole
   (C) 3-acetyl pyrrole   (D) 3-nitro pyrrole

52. The following spectroscopy gives a clear picture about the terpenoids having double bonds in conjugation

   (A) IR spectroscopy   (B) UV spectroscopy
   (C) Mass spectroscopy   (D) NMR spectroscopy

53. Indicate whether the following statements are true or false.

   (i) Cyclic disubstituted compounds do not show geometric isomerism
   (ii) R and S configuration correspond to the enantiomers of an optically active compound

   (A) (i) is false and (ii) is true   (B) (i) is true and (ii) is false
   (C) Both are true   (D) Both are false

54. If solid sodium acetate is added to a dilute solution of acetic acid, the pH will

   (A) increase   (B) be unaffected
   (C) decrease   (D) first decrease, then increase

55. Which of the following compounds is expected to show a sharp singlet for one of its protons at $\delta \geq 8$ in ^{1}H-NMR spectrum, given that this signal remains unaffected on shaking the solutions thoroughly with D_2O?

   (A) CH_3COOH (B) $CH_3CONHC_6H_5$
   (C) $n\text{-}C_6H_{13}C \equiv CH$ (D) $n\text{-}C_6H_{13}CHO$

56. Citral, when heated with $KHSO_4$, forms

   (A) Isoprene   (B) p – Cymene
   (C) p – Menthane   (D) Dipentene

57. α – Pinene hydrochloride on warming rearranges to form bornyl chloride. The rearrangement is known as

    (A) Pinacol – pinacolone   (B) Hofmann

    (C) Wagner – Meerwein   (D) Wolff

58. An auxochrome is a group which

    (A) absorbs in UV region

    (B) absorbs in visible region

    (C) absorbs in IR region

    (D) increases absorption wavelength of chromophore

59. Bakelite is a condensation polymer obtained from

    (A) Phenol and formaldehyde

    (B) Urea and formaldehyde

    (C) Glycerol and phthalic acid

    (D) Butadiene and styrene

60. Magnetic properties are not observed in nuclei with

    (A) odd mass number and odd atomic number

    (B) even mass number and odd atomic number

    (C) odd mass number and even atomic number

    (D) even mass number and even atomic number

61. Benzene on treatment with Na/ethanol in liquid ammonia gives clohexa-1,4-diene. The reaction is known as

    (A) Birch reduction   (B) Clemmenson reduction

    (C) Wolf- Kischner reduction   (D) Hydride reduction

62. Which one of the following is the organic solvent that prevents the greatest fire hazard?

    (A) Ethanol   (B) CCl_4
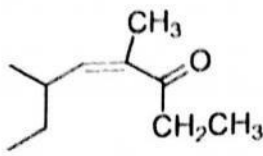
    (C) Kerosene   (D) $C_2H_5OC_2H_5$

63. Which group of compound does not involve the $\pi \rightarrow \pi^*$ transitions in UV spectroscopy?

    (A) Alkenes   (B) Azo compounds
    (C) Alcohols   (D) Cyanides

64. Which of the following undergoes Diels-Alder reaction?

    (A) Pyridine   (B) Pyrrole
    (C) Thiophene   (D) Furan

65. Which of the following is more basic in nature?

    (A) Pyrrole   (B) Aniline
    (C) Pyridine   (D) Thiophene

66. Presence of a nitro group in a benzene ring

    (A) activates the ring towards electrophilic substitution
    (B) renders the ring basic
    (C) deactivates the ring towards nucleophilic substitution
    (D) deactivates the ring towards electrophilic substitution

67. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives predominantly

    (A) Benzoyl chloride   (B) Benzyl chloride
    (C) o-and p-chlorotoluene   (D) m-chlorotoluene

68. $C_6H_5CHO + HCHO \xrightarrow{\text{NaOH}}$?

    (A) C_6H_5COOH and CH_3OH (B) $C_6H_5CH_2OH$ and $HCOOH$

    (C) $C_6H_5CH_2OH$ and CH_3OH (D) $C_6H_5CH_2COOH$ and $HCOOH$

69. Rapid interconversion of α-D-glucose and β-D-glucose in solution is known as

    (A) Mutarotation   (B) Racemization
    (C) Asymmetric induction   (D) Fluxional isomerozation

70. The IUPAC name of

is

    (A) Z-4,6-Dimethyloct-4-en-3-one
    (B) E-4,6-Dimethyloct-4-en-3-one
    (C) Z-3,5-Dimethyloct-4-en-6-one
    (D) E-3,5-Dimethyloct-4-en-6-one

71. $CH_3COCH_2COOEt \xrightarrow{\ LiAlH_4\ }$?

    (A) $CH_3CH(OH)CH_2COOEt$ (B) $CH_3CH(OH)CH_2CH_2OH$
    (C) $CH_3CH_2CH_2COOEt$ (D) $CH_3CH(OH)CH_2CHO$

72. Boiling point of 1-butanol is higher than that of 1-butanethiol due to

    (A) lower molecular mass of 1-butanol
    (B) weaker H-bonding in 1-butanol
    (C) weaker H-bonding in 1-butanethiol
    (D) None of the above

73. The pH at which the amino acid shows no tendency to migrate when placed in an electric field is known as its

    (A) Isoelectric point   (B) Dipole moment
    (C) Iodine number   (D) Wavelength

74. The five elements present in most naturally occurring proteins are

    (A) C, H, O, P and S   (B) N, C, H, O, and I
    (C) N, S, C, H, and O   (D) C, H, O, S, and I

75. Which dyes become linked to the fiber by chemical reaction?

    (A) Acid dyes   (B) Direct dyes
    (C) Disperse dyes   (D) None of the above

76. The number of signals that appear in the broad band decoupled ^{13}C NMR spectrum of ortho-, meta- and para-dichlorobenzenes respectively are

(A) 3,4 and 2
(B) 3,3 and 2
(C) 4,4 and 2
(D) 3,4 and 4

77. D(+) Glucose on reaction successively with CH_3OH/H^+, $(CH_3)_2SO_4/NaOH$, HCl, Br_2/H_2O and HNO_3 gives xylotrimethoxyglutaric acid. Then the sugar is in

(A) Pyranose form
(B) Furanose form
(C) Open chain form
(D) None of the above

78. Optical isomers that are not mirror images are called

(A) Diastereomers
(B) Enantiomers
(C) Metamers
(D) Meso compounds

79. LPG (household cooking gas) is mainly a mixture of

(A) Methane + Ethane
(B) Acetylene + O_2
(C) Butane + Isobutane
(D) Acetylene + H_2

80. Octane number is related to

(A) Gasoline
(B) Kerosene oil
(C) Diesel oil
(D) Lubricating oil

81. Propadiene , $CH_2 = C = CH_2$, is

(A) a planar compound
(B) a cumulated diene
(C) an isolated diene
(D) a conjugated diene

82. Benzaldehyde does not react with

(A) Tollen's reagent
(B) Phenylhydrazine
(C) Fehling's solution
(D) $NaHSO_3$

83. Which alcohol is the most acidic?

   (A) 1-Chloroethanol   (B) Ethanol
   (C) 1,1-Dichloroethanol   (D) 2-Chloroethanol

84. When glycerol is heated with oxalic acid at $260°C$, it gives,

   (A) 1,2-Propanediol   (B) Vinyl alcohol
   (C) 1,3-Propanediol   (D) Allyl alcohol

85. Arrange the reactivity order of the dienophile towards cyclopentadiene in Diels-Alder reaction.

   (A) I < III < II < IV   (B) II < III < IV < I
   (C) IV < III < II < I   (D) I < II < III < IV

86. Oxidation of secondary alcohol to ketone with aluminium ter-butoide is known as

   (A) Oppenauer oxidation
   (B) Mendius oxidation
   (C) Stephen's reaction
   (D) Meerwein-Pondorff-Verley reaction

87. Which of the following has most reactive carbonyl group?

   (A) Methanal   (B) Ethanal
   (C) Propanone   (D) Benzaldehyde

88. The reagent which is capable of reacting both with aldehydes as well as ketones

   (A) Schiff's reagent   (B) Tollen's reagent
   (C) Grignard reagent   (D) Fehling's solution

89. Carbonyl compounds may be converted to alkanes by the reaction

    (A) Clemmensen's reduction   (B) Wolff-Kishner reduction
    (C) Both (A) and (B)   (D) None of the above

90. Which of the following will not show haloform reaction?

    (A) C_6H_5CHO (B) CH_3CHO
    (C) CH_3COCH_3 (D) $C_6H_5COCH_3$

91. Reformatsky reaction is the reaction between a carbonyl compound, zinc and

    (A) unsaturated acid   (B) unsaturated ester
    (C) α-Haloester   (D) β- Haloester

92. Fries rearrangement reaction may be used to obtain

    (A) Aromatic aldehydes   (B) Aromatic ketones
    (C) Aromatic phenolic ketones   (D) Aromatic phenolic aldehydes

93. Which of the following will exhibit tautomerism?

    (A) Phenylnitromethane   (B) Benzylnitrite
    (C) p-Nitrotoluene   (D) All of the above

94. Identify the compound which is used as a source of nitrous acid.

    (A) Nitroethane   (B) Amyl nitrite
    (C) Amyl nitrate   (D) Nitrobenzene

95. Aniline reacts with bromine water to form

    (A) o- and p- Bromoaniline   (B) m- Bromoaniline
    (C) sym- Tribromoaniline   (D) sym- Tribromobenzene

96. The α-Helix is a common form of

    (A) Primary structure   (B) Tertiary structure
    (C) Secondary structure   (D) None of the above

97. An organic compound (A), C_3H_8O on oxidation gives (B), C_3H_6O. The compound (A) could be

 (A) an Aldehyde
 (B) a ketone
 (C) an Alcohol
 (D) an ester

98. Most stable carbocation formed from $(CH_3)_3 C-Br$, $(C_6H_5)_3 CBr$, $(C_6H_5)_2 CHBr$ and $C_6H_5CH_2Br$ would be

 (A) $C_6H_5C\overset{\oplus}{H}_2$
 (B) $(CH_3)_3 C^{\oplus}$
 (C) $(C_6H_5)_3 C^{\oplus}$
 (D) $(C_6H_5)_2 C^{\oplus}H$

99. The electroplitic aromatic substitution proceeds through a

 (A) free radical
 (B) sigma complex
 (C) benzyne
 (D) carbene

100. The most stable conformation of ethylene glycol is

 (A) anti
 (B) Gauche
 (C) partially eclipsed
 (D) fully eclipsed

101. Which of the following metals is most likely to be able to adopt an oxidation state of VI?

 (A) Cr
 (B) Co
 (C) Pt
 (D) Au

102. Which of the following compounds contains a 3-centre 4 electron bond?

 (A) PF_3
 (B) I_3^-
 (C) B_2H_6
 (D) H_2O

103. Which of the following octahedral complexes is likely to show the largest ligand field splitting?

    (A) $[Fe(H_2O)_6]^{2+}$ (B) $[FeF_6]^{4-}$

    (C) $[Fe(NH_3)_6]^{2+}$ (D) $[Fe(CN)_6]^{3-}$

104. Which of the elements in each of the following groups is the most electronegative?

    (A) Cs   (B) C

    (C) Sr   (D) Be

105. Which of the following is the correct electron configuration for the Fe^{3+} ion?

    (A) $[Ar]\ 4s^1\ 3d^5$ (B) $[Ar]\ 4s^2\ 3d^3$

    (C) $[Ar]\ 4s^1\ 3d^4$ (D) $[Ar]\ 3d^5$

106. Inert pair effect is observed in

    (A) Pt   (B) Bi

    (C) Pd   (D) Tl

107. Which of the following molecule has a T-shaped structure?

    (A) BCl_3 (B) Al_2Cl_6

    (C) BF_3 (D) BrF_3

108. Which of the following is a diamagnetic molecule?

    (A) O_2 (B) NO

    (C) O_3 (D) $[Co(H_2O)_6]^{2+}$

109. Which is the most abundant noble gas in the atmosphere?

    (A) Argon   (B) Helium

    (C) Xenon   (D) Neon

110. The ionic radii of Rb^+ and Br^- ions are 1.47Å and 1.95Å respectively. The most probable type of geometry exhibited by RbBr is

    (A) NaCl type   (B) CsCl type
    (C) Zinc blende structure   (D) wurtzite structure

111. Schottkey defect generally appears in

    (A) AgBr   (B) ZnS
    (C) AgI   (D) NaCl

112. Among the following, several pairs are isoelectronic. Identify those pairs: Fe^{2+}, Sc^{3+}, Ca^{2+}, F^-, Co^{2+}, Co^{3+}, K^{2+}, Al^{3+},

    (A) (Fe^{2+}, Co^{2+}); (Sc^{3+}, Ca^{2+}); (K^{2+}, Al^{3+})

    (B) $(Fe^{2+}, Sc^{3+},)$; (Co^{3+}, K^{2+}); (F^-, Al^{3+})

    (C) (Fe^{2+}, Co^{3+}); (Sc^{3+}, Ca^{2+}); (F^-, Al^{3+})

    (D) (Fe^{2+}, Co^{3+}); (Sc^{3+}, Ca^{2+}); (K^{2+}, Al^{3+})

113. Arrange the following in the increasing order of first ionization energy:

Sr, Cs, S, F, As

    (A) Cs < Sr < S < As < F   (B) Cs < Sr < As < S < F
    (C) Sr < CS < As < S < F   (D) Cs < Sr < As < F < S

114. Arrange the following elements in the order of decreasing metallic character: Sc, Fe, Rb, Br, O, Ca, F.

    (A) Rb > Ca > Fe > Sc > O > Br > F
    (B) Rb > Sc > Ca > Fe > Br > O > F
    (C) Ca > Rb > Sc > Fe > Br > O > F
    (D) Rb > Ca > Sc > Fe > Br > O > F

115. For a square planar complex, the order of energy of the d orbitals will be

    (A) $d_{x^2-y^2} < d_{xy} < d_{z^2} < d_{xz}\,d_{yz}$ (B) $d_{xy} < d_{x^2-y^2} < d_{xz}\,d_{yz} < d_{z^2}$

    (C) $d_{xz}\,d_{yz} < d_{z^2} < d_{xy} < d_{x^2-y^2}$ (D) $d_{xz}\,d_{yz} < d_{z^2} < d_{xy} << d_{x^2-y^2}$

116. Crystal field stabilisation energy of a high spin octahedral iron(III) complex is

    (A) $-20\,Dq$ (B) $0\,Dq$

    (C) $-20\,Dq + 2P$ (D) $-16\,Dq$

117. Arrange the following in the increasing order of their bond angles:

CH$_4$. NH$_3$, PH$_3$, AsH$_3$, H$_2$O

    (A) $H_2O < PH_3 < AsH_3 < NH_3 < CH_4$

    (B) $AsH_3 < PH_3 < H_2O < NH_3 < CH_4$

    (C) $PH_3 < AsH_3 < H_2O < NH_3 < CH_4$

    (D) $AsH_3 < PH_3 < NH_3 < H_2O < CH_4$

118. For the element with electronic configuration $[Xe]4f^{14}5d^{10}6s^26p^1$, which is the most stable oxidation state?

    (A) +3   (B) +4

    (C) +2   (D) +1

119. Which of the following complex of M (Atomic number 26) will be most stable?

    (A) $M(CO)_5$ (B) $M(CO)_4$

    (C) $[M(CO)_5]^-$ (D) $[M(CO)_6]$

120. Total number of atoms per unit cell in a face centered cubic crystal is

    (A) 4   (B) 3

    (C) 2   (D) 1

121. Aquaregia is a mixture of

    (A) three parts of conc. hydrochloric acid and one part of conc. nitric acid

    (B) three parts of conc. nitric acid and one part of hydrofluoric acid

    (C) three parts of conc. sulphuric acid and one part of conc. nitric acid

    (D) three parts of hydrofluoric acid and one part of conc. nitric acid

122. A line is detected in the visible region of the hydrogen spectrum. To which spectral series, this line belongs to?

    (A) Lyman series   (B) Balmer series
    (C) Paschen series   (D) Pfund series

123. CSFE is highest for

    (A) Fe(III) high spin octahedral complex
    (B) Mn(III) high spin octahedral complex
    (C) Co(II) high spin octahedral complex
    (D) Co(II) tetrahedral complex

124. Non stoichiometric Cu_2O is

    (A) a p-type semiconductor   (B) an n-type semiconductor
    (C) an intrinsic semiconductor   (D) an insulator

125. Ionic radii will be largest for

    (A) $[Cr(H_2O)_6]^{2+}$ (B) $[V(H_2O)_6]^{2+}$
    (C) $[Mn(H_2O)_6]^{2+}$ (D) $[Fe(H_2O)_6]^{2+}$

126. The most stable trihalide among the following compounds is

    (A) NF_3 (B) NCl_3
    (C) NBr_3 (D) NI_3

127. Extraction of alkaline earth metals is carried out by

(A) chemical reduction   (B) electrolytic reduction
(C) thermal decomposition   (D) pyrolysis

128. Which method of purification is represented by the equation?

$$Zr + I_2 \xrightarrow{200^0 C} ZrI_4 \xrightarrow{200^0 C} Zr + 2I_2$$

(A) Cupellation   (B) Kroll process
(C) van Arkel method   (D) Monds process

129. In which of the following, the magic numbers of both protons and neutrons are present?

(A) $_{50}Sn^{123}$ (B) $_{82}Pb^{208}$
(C) $_{82}Pb^{206}$ (D) $_{50}Sn^{118}$

130. A radioactive element has a half life of 20 minutes. How much time should elapse before the element reduced to 1/8 of its original value?

(A) 40 minutes   (B) 60 minutes
(C) 80 minutes   (D) 120 minutes

131. Hydrogen bomb is based on

(A) nuclear fusion   (B) nuclear fission
(C) nuclear explosion   (D) spallation reaction

132. 10^{-3} M HCl is titrated against sodium hydroxide. The best indicator would be

(A) phenolphthalein   (B) methyl orange
(C) phenol red   (D) methyl red

133. Identify the compound with the highest boiling point among the following.

(A) H_2O (B) H_2S
(C) H_2Se (D) H_2Te

134. The molecule that has linear structure is

(A) SiO_2 (B) CO_2
(C) NO_2 (D) SO_2

135. An atomic orbital is best defined as

(A) the region of space where there is maximum probability of finding an electron in the atom
(B) wave function for an electron in the atom
(C) the path that an electron follows in the atom
(D) region of space inside which the probability of finding the electron is equal to 0.99

136. Which of the following nucleides has the least stability?

(A) $_{28}Ni^{58}$ (B) $_{20}Ca^{39}$
(C) $_2He^4$ (D) $_5B^{10}$

137. IUPAC name for $[CrCl_2(H_2O)_2(NH_3)_2]$ is

(A) dichlorodiaquodiamminechromium(II)
(B) diamminediaquadichlorochromium(II)
(C) diaquadiamminedichlorochromium(II)
(D) dichlorodiaquadiamminechromium(III)

138. Which of the following is expected to form the most stable complex with soft ligands?

(A) Ag^+ (B) Mn^{7+}
(C) La^{3+} (D) Li^+

139. Which of the following is considered as a one-dimensional metal?

(A) $(PNCl_2)_n$ (B) $(SN)_x$
(C) sodium metal   (D) BN

140. The substance used as moderator in a nuclear reactor is

    (A) cadmium   (B) uranium - 235
    (C) lead   (D) heavy water

141. The CFSE of $[Co(NH_3)_6]^{3+}$ is

    (A) $24\,Dq + 2P$ (B) $-24\,Dq + 3P$
    (C) $-24\,Dq$ (D) $4\,Dq$

142. Suppose the d electron configuration in an octahedral complex of copper(II) is $d_{xy}^2, d_{xz}^2, d_{yz}^2, d_{x^2-y^2}^2, d_{z^2}^1$. The structure of the complex would be

    (A) elongated octahedron   (B) compressed octahedron
    (C) perfect octahedron   (D) squareplanar

143. La^{3+} is a

    (A) hard acid   (B) soft acid
    (C) boarder-line acid   (D) soft base

144. A substance which acts as an acid in BrF_3 is

    (A) KF   (B) SbF_5
    (C) HF   (D) HCl

145. The molecule having a C_6 axis is

    (A) Benzene   (B) Toluene
    (C) Naphthalene   (D) Pyridine

146. The first noble gas compound prepared by Niel Bartlett was

    (A) XeF_2 (B) XeO_3
    (C) $XePtF_6$ (D) XeF_4

147. SiCl₄ hydrolyses because of

   (A) the larger size of silicon
   (B) the high electronegativity of silicon
   (C) availability of d orbitals in chlorine
   (D) availability of d orbitals in silicon

148. Match the following:

Element		Flame colour
I. Lithium	(i)	Lilac
II. Sodium	(ii)	Blue-violet
III. Potassium	(iii)	Golden yellow
IV. Cesium	(iv)	Crimson

   (A) I : i, II : iii, III : iv, IV : ii   (B) I : i, II : ii, III : iv, IV : iii
   (C) I : iv, II : ii, III : i, IV : iii   (D) I : iv, II : iii, III : i, IV : ii

149. The biological role of hemoglobin is

   (A) oxygen storage
   (B) oxygen transport
   (C) electron transfer
   (D) electron transfer and oxygen transport

150. Cubic unit cell is defined by

   (A) $a \neq b \neq c, \alpha = \beta = \gamma = 90°$
   (B) $a = b = c, \alpha = \beta = \gamma = 90°$
   (C) $a = b \neq c, \alpha = \beta = \gamma = 90°, \gamma = 120°$
   (D) $a = b = c, \alpha \neq \beta \neq \gamma$

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