M.Sc. Chemistry Code No. (482)

Set No. 1 Question Booklet No. 05349

16P/206/22(i)

(To be filled up by the candidate by blue/black ball-point pen)

Roll No. | | | | | | | | | | |

Serial No. of OMR Answer Sheet ..... (2016) .....

Day and Date ..... (Signature of Invigilator)

INSTRUCTIONS TO CANDIDATES

(Use only ***blue/black ball-point pen*** in the space above and on both sides of the **Answer Sheet**)

1. Within 30 minutes of the issue of the Question Booklet, check the Question Booklet to ensure that it contains all the pages in correct sequence and that no page/question is missing. In case of faulty Question Booklet bring it to the notice of the Superintendent/Invigilators immediately to obtain a fresh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall ***except the Admit Card without its envelope***.
3. ***A separate Answer Sheet is given. It should not be folded or mutilated. A second Answer Sheet shall not be provided. Only the Answer Sheet will be evaluated.***
4. *Write your Roll Number* and Serial Number of the Answer Sheet by pen in the space provided above.
5. ***On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.***
6. ***No overwriting is allowed in the entries of Roll No., Question Booklet no. and Set no. (if any) on OMR sheet and Roll No. and OMR sheet no. on the Question Booklet.***
7. ***Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfairmeans.***
8. *Each question in this* ***Booklet is followed by four alternative answers. For each question, you are to record the correct option on the Answer Sheet by darkening the appropriate circle in the corresponding row of the Answer Sheet, by pen as mentioned in the guidelines given on the first page of the Answer Sheet.***
9. For each question, darken only one circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. *Note that the answer once filled in ink cannot be changed. If you do not wish to attempt a question, leave all the circles in the corresponding row blank (such question will be awarded zero marks).*
11. For rough work, use the inner back page of the title cover and the blank page at the end of this Booklet.
12. Deposit only **OMR *Answer Sheet*** at the end of the Test.
13. You are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

Total No. of Printed Pages : 40

[उपर्युक्त निर्देश हिन्दी में अन्तिम आवरण पृष्ठ पर दिये गए हैं।]

ROUGH WORK
रफ़ कार्य

16P/206/22(i)

No. of Questions : 150

प्रश्नों की संख्या : 150

Time : 2 $\frac{1}{2}$ Hours ***Full Marks : 450***

समय : 2 $\frac{1}{2}$ घण्टे ***पूर्णांक : 450***

Note : (1) Attempt as many questions as you can. Each question carries **3 (Three)** marks. ***One mark will be deducted for each incorrect answer.*** **Zero** mark will be awarded for each unattempted question.

(2) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

01. Which of the following sets of quantum numbers is possible for an electron is '4f' orbital :

(1) $n = 4, l = 3, m = 4, s = +\frac{1}{2}$ (2) $n = 4, l = 4, m = +4, s = +\frac{1}{2}$

(3) $n = 4, l = 3, m = +1, s = -\frac{1}{2}$ (4) $n = 4, l = 2, m = 2, s = +\frac{1}{2}$

02. In a three component system of phase equilibries the maximum number of degree of freedom can be :

(1) 4 (2) 3 (3) 2 (4) 1

03. The total change in entropy 'ds' for an irreversible process is given by :

(1) $ds = d_e s - d_i s$ (2) $ds = d_e s + d_i s$

(3) $ds = 0$ (4) $ds = -d_e s - d_i s$

Where $d_e s$ = entropy exchanged with sorroundings

$d_i s$ = entropy generated by irreversible process irr the system.

04. *The maximum* probability distribution in Fermi - Dirac statistics is equal is :

(1) $\alpha = \frac{1}{e^{(\alpha+\beta\epsilon i)}}$ (2) $\alpha = \frac{1}{e^{(\alpha+\beta\epsilon i)}+1}$

(3) $\alpha = \frac{1}{e^{(\alpha+\beta\epsilon i)}-1}$ (4) $\alpha = \frac{1}{e^{(\alpha-\beta\epsilon i)}+1}$

05. If velocity constant of a reaction is 2.0×10^{-4} sec^{-1} and rate of reaction is 8.0×10^{-4} moles lit^{-1} sec^{-1}, then the concentration of reactant will be:

(1) 2.0×10^{-4} moles lit^{-1} (2) 1.0 mole lit^{-1}

(3) 4.0 moles lit^{-1} (4) 8.0 moles lit^{-1}

06. The half-time period of a second order reaction is 90 minutes. Calculate the time required for completion for completion of 60% of the reaction :

(1) 270 minutes (2) 135 minutes

(3) 180 minutes (4) 90 minutes

07. The activation energy of a reaction can be calculated from the slope of the following graph :

(1) lnk vs T (2) lnk vs $\frac{1}{T}$ (3) $\frac{lnk}{T}$ vs $\frac{1}{T}$ (4) $\frac{T}{lnk}$ vs $\frac{1}{T}$

08. In any crystal ratio of Weiss indices of the face is 2:4:3, then the Miller indices would be :

(1) 6 3 4 (2) 3 4 6 (3) 4 3 6 (4) 6 4 3

09. At constant temperature, the change of chemical potential with change in pressure is equal to :

(1) entropy (2) partial molar enthalpy

(3) partial molar volume (4) Free energy

10. Absolute entropy of a substance can be calculated using :

(1) Zeroth Law of thermodynamics

(2) First Law of thermodynamics

(3) Second Law of thermodynamics

(4) Third Law of thermodynamics

11. Which of the following partition function has largest value :

(1) Vibrational (2) Translational

(3) electronic (4) rotational

12. Which of the following is correct expression for Helmholtz free energy (A) in terms of partition function :

(1) $A = -k \ln \theta$ (2) $A = kT \ln \theta$

(3) $A = -kT^2 \ln \theta$ (4) $A = -kT \ln \theta$

13. Which of the following is correct for most of the glasses ?

(1) $T_g = T_m$ (2) $T_g = \frac{1}{2} T_m$

(3) $T_g < T_m$ (4) $T_g > T_m$

14. Zieqler Natta catalyst is used in ..... polymerisation :

(1) Free radical (2) Auionic

(3) Cationic (4) Coordination

15. Canonical ensembles have same :

(1) T, P, N (2) T, μ, N

(3) T, V, N (4) E, V, N

16. Electro-osmotic flux is the mass flux due to difference of :

(1) Potential (2) Temperature

(3) Concentration (4) Pressure

17. The wave mechanical model of atom depends on :

(1) deBroglie equation

(2) Heisenberg, uncertainty principle

(3) Schrodinger's wave equation

(4) All of the above

18. The energy of an atom is the first Bohr orbit of hydrogen is 13.6 eV. The possible energy value in the excited state for electron in the Bohr orbit of hydrogen atom is :

(1) – 3.4 eV (2) – 4.2 eV (3) – 6.8 eV (4) 6.8 eV

19. The energy of a rigid rotator is :

(1) $E = \frac{n^2h^2}{2m}J$ (2) $E = \frac{h^2}{2\pi I}J(J+1)$

(3) $E = \frac{n^2h^2}{2m\,a^2}$ (4) $E = \frac{h^2}{\pi I}J(J+1)$

20. The decrease in free energy is equal to :

(1) mechanical work (2) Maximum work

(3) net work (4) zero

21. If Weiss indices of a face of a crystal are 1, ∞, ∞, then its Miller indices will be :

(1) 1, 0, 0 (2) 0, 1, 1 (3) 0, 1, 0 (4) 1, 0, 1

22. Maximum number of α and β particles emitted when $^{238}_{92}U$ changes to $^{206}_{82}Pb$ are :

(1) 6α and 8β (2) 8α and 8β

(3) 6α and 6β (4) 8α and 6β

23. The relation between e.m.f. and concentration for a cell is :

(1) Linear (2) Exponential

(3) Logarithimic (4) no relation

24. The spin only magnetic moment is given by :

(1) $\sqrt{45(S+1)}$ (2) $\sqrt{5(S+1)}$ (3) $\sqrt{25(S+1)}$ (4) $\sqrt{5(S+3)}$

25. The pH of a solution by mixing 50 cc of 0.2 M Hcl and 50cc of 0.1 M NaOH will be :

(1) 1.8 (2) 2.4 (3) 1.3 (4) 4.2

26. If the value of $\frac{r_c}{r_a}$ (radius ratio of cation and anion) is equal to 0.213 then coordination number of cation is :

(1) 2 (2) 4 (3) 3 (4) 6

27. How many normal modes are possible for water molecule ?

(1) 1 (2) 2 (3) 3 (4) 4

28. What will be the ESR frequency of a free electron in a magnetic field of 0.34 T. Given that g = 2.0023 and $\beta = 9.273 \times 10^{-24}$ JT^{-1}, $h = 6.626 \times 10^{-34}$ JS:

(1) 20.0 GHz (2) 09.50 GHz

(3) 19.0 GHz (4) 09.50 MHz

29. The selection rule for transition in rotational energy levels in Raman spectrum is :

(1) $\Delta J = \pm 1$ (2) $\Delta J = +1$ (3) $\Delta J = +2$ (4) $\Delta J = \pm 2$

30. The difference between the incident and scattered frequencies in the Raman spectrum is called :

(1) Stoke's line (2) Anti Stoke's line

(3) Raman frequency (4) p - branch

31. The law which relates the solubitity of a gas to its pressure is called :

(1) Roult's Law (2) Distribution Law

(3) Henry's Law (4) Ostwald's Law

32. Which of the following has a bond order 2.5 :

(1) Hc*l* (2) CO (3) NO (4) N_2

33. The equivalent conductance of a IN solution of an electrolyte is nearly :

(1) 10^3 times more than specific conductance

(2) 10^{-3} times its specific conductance

(3) 100 times its specific conductance

(4) 110 times its specific conductance

34. The term symbols for M_n and T_i atoms are :

(1) $^6S_{3/2}$ and $^3F_2$ (2) $^6S_{5/2}$ and $^3F_2$

(3) $^6S_{1/2}$ and $^3F_{3/2}$ (4) $^6S_{3/2}$ and $^3F_{1/2}$

35. The energy of a particle in a l - dimensional box is given by :

(1) $\frac{n^2 h^2}{m L^2}$ (2) $\frac{n h^2}{4 m L^2}$ (3) $\frac{n^2 h^2}{8 m^2 L^2}$ (4) $\frac{n^2 h^2}{8 m L^2}$

36. Radius of orbit in Bohr's hydrogen atom is :

(1) $r = \frac{n^2 h^2}{4 \pi e^2 m}$ (2) $r = \frac{n^2 h^2}{4 \pi e m^2}$

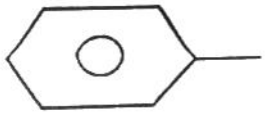
(3) $r = \frac{n^2 h^2}{8 \pi^2 e^2 m^2}$ (4) $r = \frac{n^2 h^2}{4 \pi^2 e^2 m}$

37. Assuming that the force constant for c ≡ c, c = c, c - c are in ratio 3:2:1 and normal range of c = c sketch absorption is 1630 - 1690 cm^{-1}, what range would you expect for c ≡ c stretch vibration ?

(1) 1152 - 1195 cm^{-1} (2) 1195 - 2005 cm^{-1}

(3) 2005 - 2080 cm^{-1} (4) 3260 - 3380 cm^{-1}

38. The number of NMR signals in the spectrum of



are :

(1) 4 (2) 3 (3) 2 (4) 1

39. A what field would methyl radical come into resonance in spectrometer operating at 9.5 GHz (g = 2.0026) ?

(1) 0.34 T (2) 0.68 T (3) 1.02 T (4) 0.17 T

40. Which of the following molecule will show pure rotational spectrum ?

(1) CH_4 (2) H_2O (3) C_6H_6 (4) Cl_2

41. Which one of the following compounds forms (3c - 2e) bond ?

(1) XeF_2 (2) Al_2Cl_6 (3) $Mg(CH_3)_2$ (4) $Be(NO_3)_2$

42. Hot aqueous solution of $(NH_4)NO_2$ decomposes to give N_2 gas and water. But a very small amount of two compounds (A) and (B) are also formed as impurities which are removed by passing the gas in water. Here (A) and (B) are :

(1) NO and H_2 N_2 O_2 (2) NO and HNO_3

(3) N_2O and NO_2 (4) NH_3 and N_2O

43. The laughing gas can be prepared from HNO_2 by adding :

(1) SO_2 (2) NH_2OH (3) H_2O_2 (4) Fe^{2+} salt

44. Out of the following diatomic molecules, the paramagnetic ones are

(a) Be_2 (b) B_2 (c) C_2 (d) N_2 (e) O_2 (f) F_2 (g) C^+_2, (h) C^-_2

(1) Be_2 B_2 and C_2 , N_2 (2) B_2 , C_2 , N_2 and C^-_2

(3) C_2 , N_2 , O_2 and C^+_2 (4) B_2 , O_2 , C^+_2 , C^-_2

Pick the correct choice out the above four choices

45. Which one of the following reactions saves us from the damaging effect of solar u.v. radiations ?

(1) $O_2 + h\upsilon \rightleftharpoons 2O_2$

(2) $O_3 + h\upsilon = O_2 + O$

$O + O_2 \rightleftharpoons O_3$

(3) Chloro fluoro carbon + $h\upsilon \rightleftharpoons Cl^{\bullet}$

$Cl^{\bullet} + O_3 \rightarrow ClO + O_2$

(4) $HClO + h\upsilon \rightleftharpoons OH^{\bullet} + Cl^{\bullet}$

$Cl^{\bullet} + O_3 \rightleftharpoons ClO^{\bullet} + O_2$

46. Iodine in (A) oxidation state is easily stabelized by complexation as in $[ICl_2]^{+1}$ ion which is stablc in concentrated HCl. In concentrated and strong acids $[I_2]^{+}$ is (B) cation dimerzing to (C) species $(I_4)^{+}$. Here (A), (B) and (C) are respectively :

(1) – 1, unstable, paramagnetic

(2) + 1, paramagnetic, diamagnetic

(3) – 1, diamagnetic, paramagnetic

(4) + 1, diamagnetic, stable

47. H_3PO_3 and $H_3A_5O_3$ are :

(1) both tribasic

(2) H_3PO_3 dibasic and $H_3A_5O_3$ tribasic

(3) H_3PO_3 tribasic and $H_3A_5O_3$, dibasic

(4) Both are dibasic in which H^{+} is bonded to P and As

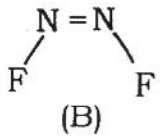
48. It is possible to prepare a complex (Octahedral or tetrahedral) of d^6 metal ion with a magnetic moment of 2.6 B.M. under the following conditions. Which one of the following alternative is correct ?

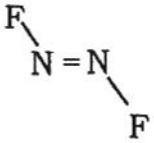
(1) An Octahedral complex of d^6 metal ion with weak field legands.
(2) A tetrahedral complex of d^6 metal ion with weak field legands.
(3) An Octahedral complex of d^6 metal ion with strong field legands.
(4) A tetrahedral complex of d^6 metal ion with strong field legands.

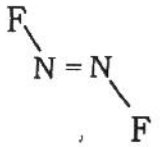
($10\ D_q^T$ >> Pairing energy)

49. The structures of two forms of N_2F_2 out of the following four structures are :

F–N=N–F
(A)


(B)


(C)
(Planar)


(D)

(N-F bonds in different planes)

Pick the correct choice out of the following ones

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

50. On hydrolysis $(CH_3 - Li)_4$ gives :

(1) $Li\ OH + CH_4$
(2) $C_2H_6 + Li\ CH_3 + Li\ (OH)$
(3) $CH_3\ OH + Li\ OH + Li\ H$
(4) $C_2H_5\ OH + Li\ OH + Li\ H$

51. Uranium, Thorium and Plutonium dissolve in :

(1) Conc. HNO_3 (2) Conc. HNO_3 + F^- ions

(3) Conc. HNO_3 + NaCl (4) Dil. HNO_3

52. Transition metal ions form complexes with N_2 molecules in two modes of linkages. (1) M–N $\equiv$ N (end on) and (2) M $\leftarrow$ $\begin{matrix} N \\ \| \\ N \end{matrix}$ (side on). The bond strenghts of these M – (N_2) bonds are (Relative strengths) :

(1) Both weak

(2) Both strong

(3) End-on stronger than side- on

(4) Side-on stronger than end- on

53. $(Ln)^{2+}$ ions are largely coloured while $(Ln)^{3+}$ are not. The colour of $(Ln)^{2+}$ is due to :

(1) f $\rightarrow$ f transition

(2) d $\rightarrow$ d transition

(3) f $\rightarrow$ d transition

(4) Charge transfer from anions or solvent to $(Ln)^{2+}$

54. The reason for (A) P_2 which is similar to N_2 molceule is not stable because (what is (A)):

(1) The bond energy of three (P - P) bonds is more than (P - P) triple bond as opposed to N ≡ N bond energy which is more than three (N - N) bond energy (A - gaseous)

(2) Lattice energy of P - P is more than N - N bond energy

(A = Solid state)

(3) Lone pairs of electrons in $\ddot{P} \equiv \ddot{P}$ is kinetically more reactive than those present on N_2 in $\ddot{N} \equiv \ddot{N}$ (A - solid state)

(4) Kinetically P - P bond is more reactive than N - N bond (A = liquid)

55. The following three reactions give one common molecule (A). What is (A) ?

(a) $(NH_4)_2\, Cr_2\, O_7 \xrightarrow[\text{decomposition}]{\text{thermal}}$

(b) $NH_3 + Br_2 \longrightarrow$

(c) $NH_3 + CuO \xrightarrow[\text{Temperature}]{\text{High}}$

Pick the correct choice out of the following :

(1) N_2O (2) NO

(3) N_2 (nitrogen) (4) NH_3

56. The magnetic moment of Mn^{2+} (d^5 case) complexes of weak field legands (Octahedra and Tetrahedral) is :

(1) Very close to spin only value

(2) Spin only value plus a large orbital contribution

(3) Spin only value plus variable orbital contribution

(4) Spin only value of one electron

57. What is (A) in the following reaction :

$$4\ HNO_3 + P_4O_{10} \xrightarrow{-10^\circ C} 2N_2O_5 + (A)$$

(1) H_3PO_4 (2) H_3PO_3

(3) HPO_3 (4) P_2O_3

58. What is (A) in the following reaction :

$$Na\ NO_3 + Na_2O \xrightarrow[\text{crucible } 300^\circ \text{ for two days}]{\text{Silver}} (A)$$

(1) N_2O_5 + Some Sodium Salt (2) No reaction

(3) $Na_3\ NO_4$ (orthonitrate) (4) $N_2O_3 + N_2 + Na_2\ NO_2$

59. $(N_5)^+$ cationic species exists in compounds $[N_5^+]\ [5b_2\ F_{11}]^-$ or in $(N_5)^+$ $[A_5F_6]^-$. The structure of $(N_5)^+$ in these compounds is :

(1) linear

(2) Angular

(3) Cyclopentadienyl type

(4) Square planar with N - N^+ side chain

60. HF in liquid state self - ionizes as :

(1) $HF\ (liq) \rightleftharpoons H^+ + F^-$

(2) $2HF\ (liq) \rightleftharpoons (H_2F)^+ + F^-$

(3) $3HF\ (liq) \rightleftharpoons (H_2F)^+ + (HF_2)^-_{(Solvated)}$

(4) $4HF\ (liq) \rightleftharpoons (H_3F_2)^+ + (HF_2)^-$

61. Arrange the hydrides CH_4, H_2O, $Ge\ H_4$, H_2Se in order of increasing acid strength. Which one is correct order in the following given orders :

(1) $CH_4 < H_2\ Se < H_2O < GeH_4$

(2) $CH_4 < GeH_4 < H_2O < H_2\ Se$

(3) $GeH_4 < CH_4 < H_2\ Se < H_2O$

(4) $GeH_4 < CH_4 < H_2\ Se < H_2O$

62. In octahedral complexes of d^1 metal ions, the net total energy of the d- electron in the complex as compared to that in the free ion :

(1) increases with respect to unbonded state

(2) varies with the nature of legands, sometimes increase and some times decreases

(3) remains the same

(4) Increases with respect to a state when only metal bond energy is considered with no electronic effects of the legands (i.e. repulsion due to legand electrons)

63. According to M.O. theory, the bond order of diatomic molecules can be (A) which is not so according to valence bond theory. Here (A) is :

(1) Integral

(2) Two

(3) Three

(4) Fractional

64. Lewis acidity of silicon tetrahalides [Si F_4, $SiCl_4$, $SiBr_4$, SiI_4] decreases in the order :

(1) $SiI_4 > SiBr_4 > SiCl_4 > SiF_4$

(2) $SiI_4 > SiCl_4 > SiBr_4 > SiF_4$

(3) $SiF_4 > SiCl_4 > SiBr_4 > SiI_4$

(4) $SiF_4 > SiBr_4 > SiI_4 > SiCl_4$

65. Arrange the single bond energy of the following fluorides in increasing order : N - F, P - F, As - F, Sb - F.

(1) N - F < Sb - F < As - F < P - F

(2) Sb - F < As - F < P - F < N - F

(3) As - F < Sb - F < P - F < N - F

(4) As - F < N - F < P - F < Sb - F

66. The oxidizing and the reducing agent in the following redox reactions respectively are :

(a) $2H\ CuCl \rightleftharpoons Cu + Cu^{2+} + 4Cl^- + 2H^+$

(b) $Cl_2 + 2OH^- \rightarrow ClO^- + Cl^- + H_2O$

(c) $Ca\ CO_3 \rightarrow CaO + CO_2$

(1) (Cu^+, Cu^{+1}), (Cl^0 Cl^0), none

(2) (H^+, Cu^+), (Cl^0,OH^-), (Ca^{2+}, O_3^{2-})

(3) (Cu^+, Cl^-), (Cl^0,OH^-), (Ca^{2+}, CO_3^{2-})

(4) (Cu^+, Cl), (Cl^0,OH^-), (Ca^{2+}, O^{2-})

67. In compounds containing X - H and X - D bonds, which one (X - H or X - D) will be stronger and why ?

(1) (X - D) because of higher contribution of covalency in X - H bond

(2) (X -H) because of greater moblity of H compared to D

(3) (X - H) because of its lower zero point energy compared to that of X-D

(4) (X - D) beacuse of its lower zero point energy compered to that of X-H

68. Which one of the following molecules will show optical isomerism ?

(1) $[Co\ (en)_3]^3$ (octahedral)

(2) $[Mn(CN)\ (NO_2)\ (H_2O)(NH_3)]$ (tetrahedral)

(3) $[Co\ (en)\ Cl_3Br]^-$ (octahedral)

(4) Cis $[Co\ (en)_2\ Cl_2]$ (octahedral) (trans)

69. What happens when in the absence of air $B_2\ H_6$ is heated to 100°C ? If :

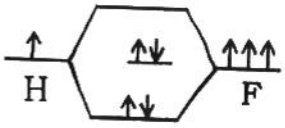
(1) decomposes to B and H_2

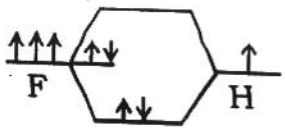
(2) explodes and gives a number of products

(3) forms $B_{10}\ H_{14}$

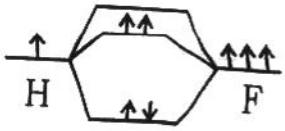
(4) forms $(BH_4)^-$, $B + H_2$

70. Which one of the following M. O.'s of $(HF_2)^-$ is correct ?

(1) 

(2) 

(3) 

(4) 

71. What product one forms by absorbing nitrous acid fumes in $Na_2 CO_3$ aqueous solution ?

(1) $Na NO_3$ (2) $Na NO_2$

(3) $H_2 N_2 O_2$ (4) $NO + N_2O$

72. SO_3, exists in three forms which have the molecular formula SO_3, $S_3 O_9$ and $(SO_3)_n$. Their structures belong to three of the following ones. The structures of these forms respectively are.

(a) atomic, (b) molecular (c) oligomeric (linear, cyclic, cluster) (d) Polymer (one dimensional chain)

Which one out of the three you will expect to be a gas your choices are the following. Pick up the right choice ?

(1) monomeric molecular, Oligomeric (Chain), polymer (linear) (SO_2)

(2) atomic, polymeric (Cyclic), 3- dimensional polymeric (S_3O_9)

(3) molecular, polymer (Cyclic), polymer (3 - dimensional) $(S_3 O_9)$

(4) molecular (monomeric), polymer (chain), polymer (3-dimensional). SO_3

73. Out of C, Si, Sn, Pb and B_1 the element with the highest atomization energy and the element with the lowest atomization energy are :

(1) Carbon and Tin (2) B and Pb

(3) C and Pb (4) B and Sn

74. Arrange the following oxygen molecular ions and the molecule in order of increasing bond energy or in decreasig order of (O-O) bond length. The molecular ions and the molecule are : $O_2^{2+}, O_2^+, O_2, O_2^-$ and O_2^{2-}. The possible orders are given below. Choose the correct one :

(1) $O_2 < O_2^+ < O_2^- < O_2^{2+} < O_2^{2-}$

(2) $O_2^{2-} < O_2^- < O_2 < O_2^+ < O_2^{2+}$

(3) $O_2 < O_2^- < O_2^{2-} < O_2^+ < O_2^{2+}$

(4) $O_2^- < O_2^{2-} < O_2 < O_2^{2+} < O_2^+$

75. What is (A) in the following equation $(Ti_3\ N_4)_5 + H_2O \rightarrow (A) + Ti\ O_2$ Here A is :

(1) $N\ H_2OH$

(2) NH_3

(3) $N_2O + NH_3$

(4) $N_2\ H_4 + H_2O_2$

76. C_2, BN, Be O and Li F molecules are isoelectronic and their valence electron ortbital energies are quite different. The difference between orbital energies of A and B of AB type molecules inereases from carbon to Li - F. It implies that the degree of overlap of the parent orbitals *(A and B)* :

(1) decreases

(2) Increases

(3) Zero in C_2 and infinite in LiF

(4) Zero in Li F and infinite in C_2

77. For a given legand, the order of metal ions producing increasing 10Dq value for octahedral complexes is (A) and for a given metal ion, the order of legands producing increasing 10Dq for octahedral complexes is (B). Here (A) and (B) :

(1) Both (A) and (B) constant

(2) (A) - changes and B = constant

(3) (A) - constant and B = changes

(4) Both (A) and (B) = changes

78. In Li_3 N, nitrogen is present as (A) and (B) than L_i^+ ion. Pick up the correct alternative from the following alternatives. Here (A) and (B) respectively are :

(1) N_2^-, N_2^- is greater than

(2) N^{3-}, N^{3-} is greater

(3) N^{3-}, N^{3-} is smaller

(4) N_3^-, N_3^- is smaller

79. The third conization energy of the first transition series show a sharp drop at Fe^{2+}, ($3d^6$) ion. The reason for this drop is due to :

(1) Increased electron-electron repulsion energy caused due to pairing of d- electrons

(2) drop in effective nuclear change

(3) the presence of large number of electrons

(4) increased electronegativity of Fe^{2+} ion

80. The following two equations are given :

(a) $Na\ (g) \rightleftharpoons Na^+(g) + e^-$ ..... $\Delta H = +\ 495$ KJ/mol

(b) $Cl^-\ (g) \rightleftharpoons Cl\ (g) + e^-$ ..... $\Delta H = 348.9$ KJ/mol

The reactions (a) and (b) respectively are known as :

(1) Electron affinity of sodium and electron affinity of Cl^- ion

(2) Ionization energy of sodium and Ionization energy of Cl^- ion

(3) Ionization energy of sodium and Electron affinity of Cl^- ion

(4) Electron affinity of Na and Ionization energy of $Cl^-(g)$

81. Which of the following species is formed when both atoms / groups are eliminated from the same carbon ?

(1) carbocation (2) carbene

(3) carbanion (4) ketene

82. The stereochemical outcome of the SN^2 reaction on an optically active substrate will be :

(1) Inversion in configuration

(2) Retention in configuration

(3) Partial racemization

(4) Complete racemization

83. The designation D or L before the name of a monosaccharide *indicates* :

(1) The length of the carbon chain in the sugar

(2) the direction of rotation of polarized light

(3) the position of the -OH group on the carbon chain next to the primary alcohol group

(4) The position of the chiral carbon atoms in the carbohydrate

84. The S_N2 mechanism best applies to the reaction between :

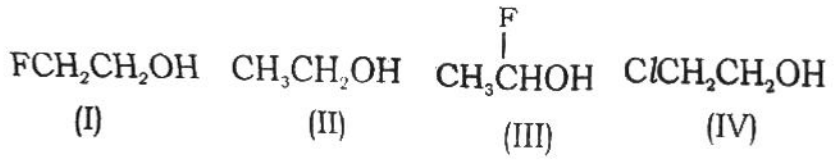
(1) cyclopropane and H_2

(2) methane and Cl_2

(3) 2-chloro - 2 – methylpropane and dilute OH^-

(4) 1 - chlorobutane and aqueous NaOH

85. List the following compounds in order of decreasing acidity :

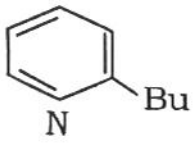


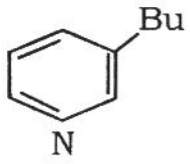
(I) (II) (III) (IV)

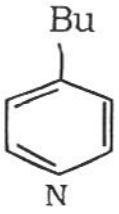
(1) I > III > IV > II (2) III > IV > I > II

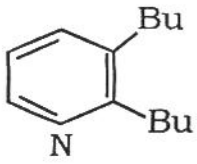
(3) III > I > IV > II (4) I > IV > II > III

86. When heated with n- butyl lithium at 100° C pyridine forms :

(1) 

(2) 

(3) 

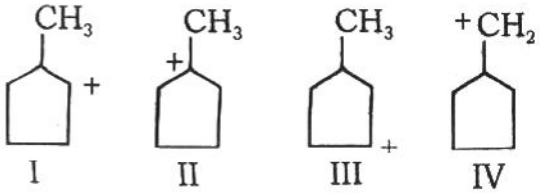
(4) 

87. Conversion of cyclohexanone oxime to caprolactam can be effected by :

(1) Beckmann rearrangement (2) Hofmann rearrangement

(3) Claisen rearrangement (4) Claisen condensation

88. The decreasing order of stability of the following carbocations is :



(1) I > II > III > IV (2) II > III > I > IV

(3) II > I > III > IV (4) III > I > II > IV

89. Bimolecular reduction of acetone in the presence of Mg amalgam in ether gives :

(1) Isopropanol (2) Propane -1, 2 - diol

(3) Pinacol (4) Propane

90. Which of the following statements is wrong about citral ?

(1) The molecule has two double bonds

(2) An aldehyde group is present

(3) One of the products obtained from ozonolysis of citral is acetone

(4) It is an opticlly active compound

91. Proteins on heating with conc. HNO_3 produce yellow colour. This is known as :

(1) Millon's test

(2) Hopkin's test

(3) Ninhydrin test

(4) Xanthoproteic test

92. The reagent 'X' in the following reaction is :

$$CH_3COCH_3 \xrightarrow{X\ ?} (CH_3)_2\underset{\displaystyle OH}{\underset{|}{C}}-CH_2COCH_3$$

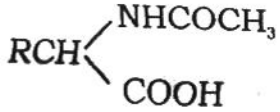
(1) HCl

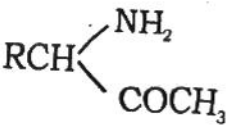
(2) $Ba(OH)_2$

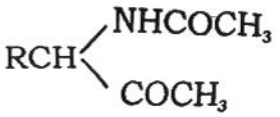
(3) H_2SO_4

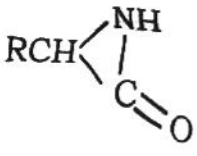
(4) $NaBH_4$

93. When heated with acetic anhydride in pyridine solution, α-aminoacids are converted into :

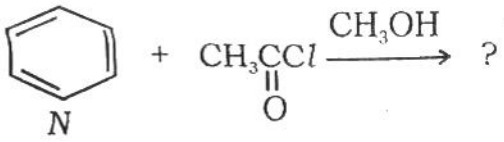
(1) 

(2) 

(3) 

(4) 

94. Give the product of the following reaction :



(1) 2 - acetylpyridine

(2) 3 - acetylpyridine

(3) 4 - acetylpyridine

(4) CH_3COCH_3 (O)

95. The decreasing order of reaction rate of the following benzyl alcohols with HBr is :

(I) $C_6H_5CH_2OH$

(II) p-$NO_2C_6H_4CH_2OH$

(III) p-$CH_3OC_6H_4CH_2OH$

(IV) p-$ClC_6H_4CH_2OH$

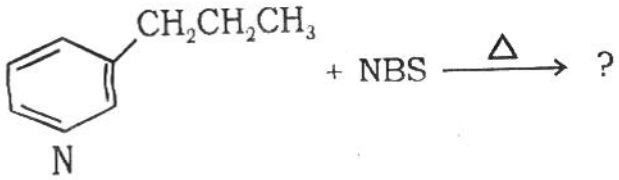
(1) III > IV > I > II

(2) III > I > IV > II

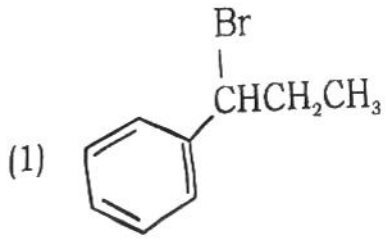
(3) III > I > II > IV

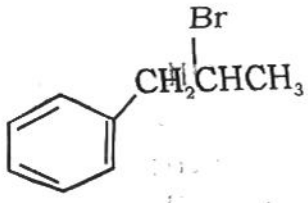
(4) I > III > IV > II

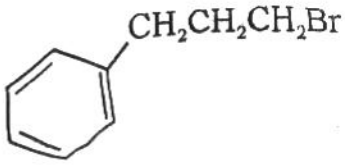
96. In the following reaction :

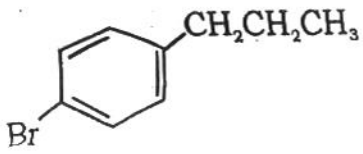


the major product is :

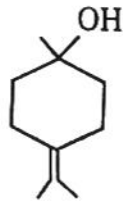
(1) 

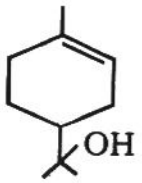
(2) 

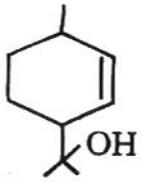
(3) 

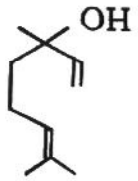
(4) 

97. One of the following structures is that of α - Terpineol. Which one ?

(1) 

(2) 

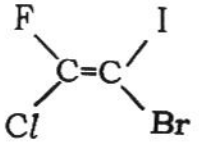
(3) 

(4) 

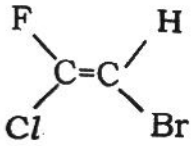
98. The major product obtained on treatment of 2-bromobutane with alcoholic KOH is :

(1) 1-butane
(2) cis - 2 - butane
(3) trans - 2 - butane
(4) 2 - butanol

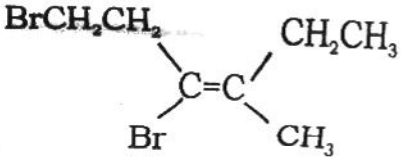
99. Which of the following alkenes have E - configuration ?



(I)



(II)



(II)

(1) I and II
(2) I and III
(3) II and III
(4) All I, II and III

100. Rapid interconversion of α -D- glucose and β - D - glucose in aqueous solution is known as :

(1) inversion
(2) epimerization
(3) racemization
(4) mutarotation

101. Which one of the following is most likely to undergo free-radical addition to an alkene ?

(1) HF (2) HC*l* (3) HBr (4) HI

102. Which one of the following rearrangements involves an electron deficient oxygen atom ?

(1) Baeyer - villiger rearrangement
(2) Pinacol - pinacolone rearrangement
(3) Hofmann rearrangement
(4) Wolff rearrangement

103. Ranks the basicities of the following compounds :

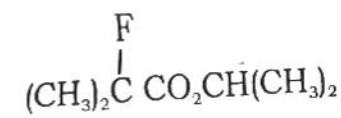
(A) NH_3
(B) CH_3NH_2
(C) $(CH_3)_4N^+ NO_3^-$

(1) B > C > A (2) C > A > B
(3) C > B > A (4) B > A > C

104. Bakelite is formed by the condensation of :

(1) Formaldehyde and urea
(2) Phenol and formaldehyde
(3) Phthalic anhydride and glycerol
(4) Methyl terephthalate and ethylene glycol

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



(1) Isopropyl 2-fluoro-3-methylbutanoate
(2) 1-Methylethyl 2- fluorobutyrate
(3) 2- Fluoroisopropyl isopropanoate
(4) 1-Methylethyl 2-fluoro - 2 - methylpropanoate

106. Identify the compounds which fail to undergo Friedel-Crafts reaction :

Naphthalene	Pyridine	Aniline	Phenanthrene
(I)	(II)	(III)	(IV)

(1) II and III
(2) II, III and IV
(3) I, II and IV
(4) II and IV

107. Which of the following is a false statement about the alkaloid piperine ?

(1) This occurs in black pepper
(2) The molecule has a methylenedioxy group
(3) It is a secondary amide
(4) Piperine can be easily synthesized starting from catechol

108. Teflon is obtained by polymerization of the monomer :

(1) $CH_2 = CF_2$
(2) $CF_2 = CF_2$
(3) $CH_2 = CHF$
(4) $CH_2 = C(CH_3)COOCH_3$

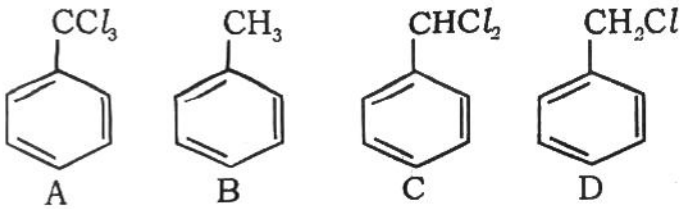
109. Stereochemically controlled polymers can be made by *polymerization* process involving :

(1) Anionic mechanism
(2) Cationic mechanism
(3) Coordination mechanism
(4) Free - radical mechanism

110. Which one of the following is classified as a dye from xanthen group ?

(1) Malachite green
(2) Methyl orange
(3) Indigo
(4) Fluorescein

111. Arrange the compounds in order of **decreasing** reactivity toward electrophilic substitution :



(1) B > D > C > A
(2) A > C > D > B
(3) B > C > D > A
(4) C > D > A > B

112. Which of the following groups are <u>meta</u>-directing in *electrophilic* aromatic substitution in benzene ring ?

$-CONH_2$ $-NHCH_3$ $-NHCOCH_3$ $-\overset{+}{N}(CH_3)_3$

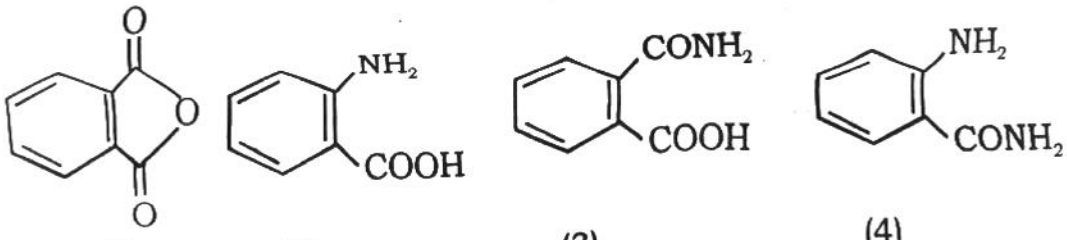
(a) (b) (c) (d)

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

113. In the reaction sequence,

Naphthalene $\xrightarrow[V_2O_5]{air}$? $\xrightarrow{NH_3}$? $\xrightarrow[OH^-]{NaOCl}$ Q

the end product Q is :



(1) (2) (3) (4)

114. Which reactive intermediate is involved in the following reaction ?

2- Methylbutane $\xrightarrow[h\upsilon]{Br_2}$ 2- Bromo - 3 - methylbutane

(not the major product)

(1) A secondary radical (2) A tertiary radical

(3) A secondary carbocation (4) A tertiary carbocation

115. The number of chiral carbon atoms present in the D-glucopyranose molecule is :

(1) three (2) four (3) five (4) six

116. Naphthalene undergoes nitration with a mixture of conc. HNO_3 and H_2SO_4 at 50°C to give mainly :

(1) 1-Nitronaphthalene (2) 2-Nitronaphthalene

(3) 1,3-Dinitronaphthalene (4) 1,8-Dinitronaphthalene

117. Identify the most reactive compound toward dehydrohalogenation by a strong base :

(1) 1-Bromopentane (2) 2-Bromopentane

(3) 3-Bromopentane (4) 2-Bromo-2-methylbutane

118. When aniline is heated with glycerol in the presence of sulphuric acid and nitrobenzene, it gives quinoline. This reaction is called :

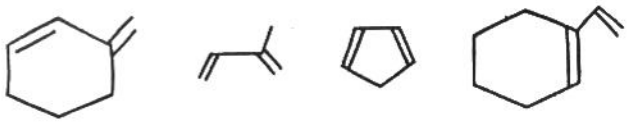
(1) Chichibabin reaction

(2) Skraup synthesis

(3) Fischer synthesis

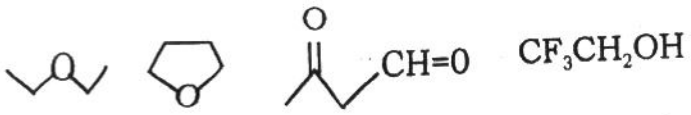
(4) Bischler - Napieralski synthesis

119. Which of the following conjugated dienes would not react with a dienophile in Diels-Alder reaction ?



(1) (2) (3) (4)

120. Two of the following four compounds are more acidic than methanol. Which ones ?



A B C D

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

121. Serum is the fluid :

(1) Supernated from the blood
(2) Separated from the clotted blood
(3) Separated from the unclotted blood
(4) Separated from the mixture of clotted blood and unclotted blood

122. Standard addition calibration is used :

(1) to obtain precised result
(2) to obtain accurate result
(3) to overcome sample matrix effects
(4) to enhance sensitivity of the result

123. In the following operation

$$\frac{35.63 \times 0.581 \times 0.05300}{1.1689} \times 100\% = 88.5470578\%$$ the answer with significant figures is :

(1) 88.55%
(2) 88.547%
(3) 88.54705%
(4) 88.5470578%

124. The results of an analysis is 36.97 g compared with the accepted value of 37.06 g. The relative error in parts per thousand (ppt) is :

(1) – 2.0 ppt
(2) –2.1 ppt
(3) – 2.3 ppt
(4) – 2.4 ppt

125. How many g/mL of NaCl are contained in a 0.250 M solution ?

(1) 0.0146 g/mL
(2) 0.146 g/mL
(3) 14.6 g/mL
(4) 0.00146 g/mL

126. The pH of 10^{-9} M HCl is :

(1) 9.00
(2) 0.90
(3) 6.00
(4) 6.99

127. The pH of a solution prepared by adding 25 ML of 0.10 M sodium hydroxide to 30mL of 0.20 M acetic acid (pK = 476) is :

(1) 4.68
(2) 4.61
(3) 4.90
(4) 5.7

128. The correlation between distribution ratio (D) and distribution coefficient (K_D) can be represented as :

(1) $D = K_D/\{1 + Ka/[H^+]\}$ (2) $K_D = D/\{1 + Ka/[H^+]\}$

(3) $K_D = D/\{ Ka/[H^+]\}$ (4) $D = K_D/\{ Ka/[H^+]\}$

129. Craig counter current distribution involves :

(1) no extraction (2) single extraction

(3) Sucessive extractions (4) solute dissolution

130. The van Deemter equation is :

(1) $HETP = A + \frac{\bar{\mu}}{B} + \frac{C}{\bar{\mu}}$ (2) $HETP = A\bar{\mu} + B + \frac{C}{\bar{\mu}}$

(3) $HETP = A + \frac{B}{\bar{\mu}} + C\bar{\mu}$ (4) $HETP = \frac{A}{B} + \frac{1}{\bar{\mu}} + \frac{\bar{\mu}}{C}$

131. The retention time in column chromatography can be defined as :

(1) the time required for the mobile phase to traverse the column

(2) the time required for the stationary phase to elute the analyte

(3) the time required for the stationary phase to bind the analyte

(4) the time required for the analyte peak to appear

132. The unit of specific absorptivity is :

(1) $Cm^{-1}\ mol^{-1}\ L$ (2) $Cm^{-1}\ g^{-1}\ L$

(3) $Cm^{-1}\ mol\ L^{-1}$ (4) $Cm^{-1}\ g\ L^{-1}$

133. In spectrophotometric analysis, the minimum relative error in the concentration occurs when percent transmittance measured is :

(1) 20% (2) 80% (3) 37% (4) 50%

134. Which is main ingradiant of ferroin ?

(1) oxine
(2) dithiozone
(3) o-phenaothroline
(4) ferrocene

135. Five mole of $KBrO_3$ in bromate - bromide reaction procedues :

(1) one mole Br_2
(2) four mole Br_2
(3) fifteen mole Br_2
(4) no Br_2

136. Metal - EDTA complexation is a pH-controlled process. Can you use an acid indicator if you do not have suitable metal indicator ?

(1) Yes
(2) No
(3) Can not say
(4) wait till arrangement of metal ion indicator is made

137. Chloramine-T and Eriochrome Black-T are used in chemical analysis because :

(1) both are indicators
(2) both are redox reagents
(3) one is redox reagent and other is an indicator
(4) both are same but called by different names

138. Which one acts as a sink of CO_2 gas ?

(1) Ocean (2) River (3) Glaciers (4) Land

139. Which reaction represents the process of respiration ?

(1) $CO_2 + H_2O + h\upsilon = (CH_2O) + O_2$
(2) $(CH_2O) + O_2 = CO_2 + H_2O + CO_2$
(3) $CH_4 + 2O_2 = CO_2 + 2H_2O$
(4) $O_2 + 4FeO = 2Fe_2O_3$

140. The altitude range of troposphere is :

(1) 0 - 11 Km
(2) 11 - 50 Km
(3) 50 - 85 Km
(4) 85 - 500 Km

141. Aitken particles are actually :

(1) aerosols with diameter more than 0.2 μ

(2) aerosols with diameter less than 0.2 μ

(3) aerosols with diameter more than 2.0 μ

(4) aerosols with diameter less than 2.0 μ

142. Van Allen belts are :

(1) Consisted of two belts of ionizing particles encircling the earth

(2) Consisted of two belts of ionizing particles encircling the moon

(3) Consisted of more than two belts of ionizing particle encircling the sun

(4) Consisted of a single belt of ionizing particle encircling the uncharged particulates

143. Which one does **not** affect the Ozone detoriation ?

(1) HO (2) NO (3) O (4) H_2

144. Atmospheric window which do not allow to escape of infrared radiation emitting from the earth is in between :

(1) 4000 — 8000 nm (2) 8000 — 16000 nm

(3) 16000 — 20000 nm (4) 20000 — 24000 nm

145. Which one is man culprite to contribute greenhouse effect ?

(1) CH_4 (2) O_3 (3) CFC (4) CO_2

146. *El* Nino is due to :

(1) warming of waters of the Eastern Pacific ocean

(2) cooling of waters of the Eastern Pacific ocean

(3) warming of waters of the Western Pacific ocean

(4) cooling of waters of the Western Pacific ocean

147. The pH of sea water is constant as :

(1) 7.0 (2) 8.1 (3) 6.5 (4) 10.2

148. Which metal is responsible for the manifestation of itai itai diseases ?

(1) As (2) Pb (3) Hg (4) Cd

149. Quadrivalent cerium is best oxidising reagent beacause :

(1) it is easily available

(2) its aqueous solution is highly stable at high temperature

(3) it is cheaper

(4) it does not require any primary standard for standardization

150. Oxine is a precipitating reagent. How can you easily determine this reagent quantitatively at trace level ?

(1) Precipitation method (2) Spectrophotometric method

(3) Conductometric method (4) $BrO_3^- - Br^-$ reaction method

ROUGH WORK
रफ़ कार्य

ROUGH WORK
रफ़ कार्य

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण पृष्ठ पर तथा उत्तर-पत्र के दोनों पृष्ठों पर केवल नीली-काली बाल-प्वाइंट पेन से ही लिखें)

1. प्रश्न पुस्तिका मिलने के 30 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।
2. परीक्षा भवन में ***लिफाफा रहित प्रवेश-पत्र के अतिरिक्त,*** लिखा या सादा कोई भी खुला कागज साथ में न लायें।
3. ***उत्तर-पत्र अलग से दिया गया है। इसे न तो मोड़ें और न ही विकृत करें। दूसरा उत्तर-पत्र नहीं दिया जायेगा। केवल उत्तर-पत्र का ही मूल्यांकन किया जायेगा।***
4. अपना अनुक्रमांक तथा उत्तर-पत्र का क्रमांक प्रथम आवरण-पृष्ठ पर पेन से निर्धारित स्थान पर लिखें।
5. ***उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।***
6. ***ओ० एम० आर० पत्र पर अनुक्रमांक संख्या, प्रश्नपुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्नपुस्तिका पर अनुक्रमांक और ओ० एम० आर० पत्र संख्या की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।***
7. ***उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।***
8. ***प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिए आपको उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।***
9. प्रत्येक प्रश्न के उत्तर के लिए केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।
10. ***ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है। यदि आप किसी प्रश्न का उत्तर नहीं देना चाहते हैं, तो संबंधित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।***
11. रफ कार्य के लिए प्रश्न-पुस्तिका के मुखपृष्ठ के अंदर वाला पृष्ठ तथा उत्तर-पुस्तिका के अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त केवल ***ओ एम आर उत्तर-पत्र*** परीक्षा भवन में जमा कर दें।
13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।
14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।