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M.Phil./Ph.D./URS-EE-Oct.-2017
SUBJECT : Chemistry

$\boxed{\text{A}}$

Sr. No. ....**10057**......

Time : 1¼ **Hours**   Max. Marks : **100**   Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Father's Name_____

Mother's Name_____ Date of Examination_____

_____   _____
(Signature of the Candidate)   (Signature of the Invigilator)

SEAL

**CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.**

1. *All questions are compulsory.*

2. The candidates **must return** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.

3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.

4. The candidate **must not** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers **must not** be ticked in the question booklet.

5. *There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.*

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7. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.*

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A

1. The ground states of high spin octahedral and tetrahedral Co(II) complexes are respectively :

   (1) $^4T_{2g}$ and $^4A_2$ (2) $^4T_{1g}$ and $^4A_2$ (3) $^3T_{1g}$ and $^4A_2$ (4) $^4T_{1g}$ and $^3T_1$

2. A true statement about base hydrolysis of $\left[Co(NH_3)_5Cl\right]^{2+}$:

   (1) It is first order reaction

   (2) The rate determining step involves the dissociation of chloride in $\left[Co(NH_3)_4(NH_2)Cl\right]^+$

   (3) The rate is independent of the concentration of the base

   (4) The rate determining step involves the abstraction of a proton from $\left[Co(NH_3)_5Cl\right]^{2+}$

3. $B_{10}C_2H_{12}$ is isoelectronic with :

   (1) $B_{12}H_{12}^{2-}$ (2) $B_{12}H_{12}$ (3) $B_{12}H_{12}^{2+}$ (4) $B_{12}H_{12}^{4-}$

4. Which of the following is the strongest oxidizing agent ?

   (1) In^{3+} (2) Ga^{3+} (3) Ti^{3+} (4) Al^{3+}

5. Electron transfer from $\left[Fe(H_2O)_6\right]^{2+}$ to $\left[Fe(H_2O)_6\right]^{3+}$ is likely to occur via :

   (1) d-d transition   (2) inner sphere electron transfer

   (3) SN^1 mechanism   (4) outer sphere electron transfer

6. The neutral complex which follows 18-electron rule is :

   (1) $\left(\eta^5-C_5H_5\right)Fe(CO)_2$ (2) $\left(\eta^5-C_5H_5\right)Mo(CO)_3$

   (3) $\left(\eta^5-C_5H_5\right)Co$ (4) $\left(\eta^5-C_5H_5\right)Re\left(\eta^5-C_6H_6\right)$

7. The degree of hydration is expected to the maximum for :

   (1) Mg^{2+} (2) Na^+ (3) Ba^{2+} (4) K^+

8. For this system in equilibrium $CaCO_3(s) \rightleftharpoons CaO(s)+CO_2(g)$ the number of components (C), phases (P) and degree of freedom (F), respectively are :

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

9. The compound having highest melting point :

   (1) $LiCl$ (2) LiF (3) $LiBr$ (4) LiI

10. The pH of a $1.0 \times 10^{-3} \mu$ solution of a weak acid HA is 4.0. The dissociation constant k_a is :

(1) 1.0×10^{-3}
(2) 1.0×10^{-4}
(3) 1.0×10^{-5}
(4) 1.0×10^{-6}

11. If k_{sp} is the solubility product of a Sparingly soluble salt A_3X_2, then its solubility is :

(1) $(k_{sp}/108)^{1/5}$
(2) $(k_{sp}/72)^{1/5}$
(3) $(k_{sp})^{1/5}$
(4) $(k_{sp})^{1/2}$

12. The radioactive isotope used to locate brain tumors is :

(1) $_1^2 D$
(2) $_7^{15} N$
(3) $_{53}^{113} I$
(4) $_6^{13} C$

13. The Bronsted acidity of boron hydrides follows the trend :

(1) $B_2H_6 > B_4H_{10} > B_5H_9 > B_{10}H_{14}$

(2) $B_5H_9 > B_4H_{10} > B_2H_6 > B_{10}H_{14}$

(3) $B_2H_6 = B_4H_{10} > B_5H_9 = B_{10}H_{14}$

(4) $B_{10}H_{14} > B_5H_9 > B_4H_{10} > B_2H_6$

14. The free energy change (ΔG) of 1 mole of ideal gas which is compressed isothermally from 1 atm to 2 atm is :

(1) $-RT \ln 2$
(2) RT
(3) $RT \ln 2$
(4) $-RT$

15. Among the following, the system that would require least amount of thermal energy to bring its temperature to 80°C is :

(1) 200 g of water at 40°C
(2) 300 g of water at 30°C

(3) 100 g of water at 20°C
(4) 150 g of water at 50°C

16. The point group symmetry of p-dichlorobenzene is :

(1) C_{2v}
(2) D_{2h}
(3) D_3
(4) C_{2h}

17. A certain buffer solution contains equal concentrations of A^- and HA. The kb for A^- is 10^{-10}. The pH of solution is :

(1) 7
(2) 10
(3) 4
(4) 14

18. The spontaneity of a reaction can be judged from the sign of emf (E) and free energy change (G) of the cell :

(1) $\Delta G = +ve, E = -ve$
(2) $\Delta G = 0, E = 0$
(3) $\Delta G = -ve, E = +ve$
(4) $\Delta G = -ve, E = -ve$

19. An aqueous solution is prepared by mixing equal volume of 0.1 M KCl and 0.1 M KI. To this solution a drop of 0.01 M $AgNO_3$ solution is added. Which of the following is correct ?

    (1) A precipitate forms which is primarily AgI

    (2) A precipitate forms which is primarily $AgCl$

    (3) A precipitate forms which is primarily AgI and $AgCl$

    (4) There will be no precipitation as there is no common ions between potassium and silver salts

20. An example of a colligative property is :

    (1) Vapour pressure   (2) Freezing point

    (3) Osmotic pressure   (4) All

21. R–(–)–2–Bromooctane on reaction with aqueous KOH mainly gives 2-octanol that is :

    (1) optically active with 'R' configuration

    (2) a racemic mixture

    (3) optically active with 'S' configuration

    (4) a meso compound

22. The correct order of acidity among :
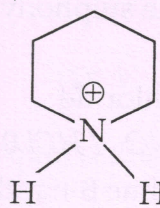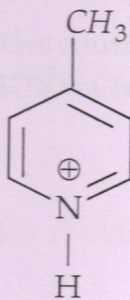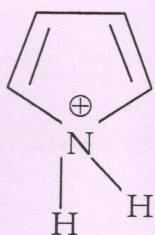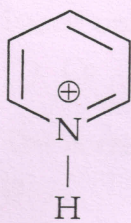
    (1) (i) < (ii) < (iii) < (iv)   (2) (iv) < (iii) < (i) < (ii)

    (3) (ii) < (i) < (iii) < (iv)   (4) (ii) < (iv) < (i) < (iii)

23. At room temperature, the number of singlet resonance observed in the ^1H spectrum of $Me_3CC(O)NMe_2$ is :

    (1) 3   (2) 4   (3) 5   (4) 2

24. The exceptionally low carbonyl stretching frequency (1650 cm^{-1}) in 2, 4, 6-cycloheptatrienone is due to :

(1) conjugation effect　　　　　(2) steric effect

(3) field effect　　　　　　　　(4) electronic effect

25. Conversion of $PhNH_2$ to $PhCN$ can be done by :

(1) reaction with $NaCN$ in the presence of Ni catalyst

(2) reaction with $CHCl_3$ and $NaOH$

(3) diazotization followed by the reaction with $CuCN$

(4) reaction with ethylformate followed by the reaction with $NaCN$

26. The major product formed in the reaction of anisole with Lithium, liquid ammonia and t-butanol is :

(1) 1-methoxycyclohexa-1, 3-diene　　　(2) 2-methoxycyclohexa-1, 3-diene

(3) 1-methoxycyclohexa-1, 4-diene　　　(4) 3-methoxycyclohexa-1, 4-diene

27. Which of the following molecules have n → π* transition at the lowest wavelength ?
(1) $HCHO$　　　(2) $CH_3COC_6H_5$　　(3) $CH_3COC_2H_5$　　(4) $C_6H_5COC_6H_5$

28. Aniline can be distinguished from methyl amine by its reaction with :
(1) p-toluene sulphonyl chloride/KOH
(2) Sn/HCl
(3) Acetyl chloride
(4) (i) $NaNO_2 / HCl \, 0 - 5°C$
　　 (ii) alkaline β-napthol

29. SN^1 reaction on optically active substrates mainly give :
(1) retention in configuration　　　(2) inversion in configuration
(3) racemic product　　　　　　　(4) no product

30. Which among the following is solvolysed at the faster rate ?
(1) $C_6H_5CH_2Cl$　　　　　　　　(2) $Me_3C - Cl$
(3) $CH_2 = CH - CH_2Cl$　　　　　(4) $(C_6H_5)_3C - Cl$

31. When benzene sulphonic acid and p-nitrophenol are treated with $NaHCO_3$ the gases released, respectively are :

    (1) SO_2, NO_2 (2) SO_2, NO (3) CO_2, CO_2 (4) SO_2, CO_2

32. Which of the following pairs give positive Tollen's test ?

    (1) Glucose, Sucrose   (2) Glucose, Fructose

    (3) Hexanal, Acetophenone   (4) Fructose, Sucrose

33. What configuration are found in the product(s) of the reaction ?
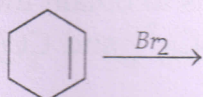
    (1) 1s, 2s only   (2) 1R, 2s only

    (3) 1R, 2R only   (4) equal mixture of 1R, 2R and 1s, 2s

34. The compound which shows L ← M charge transfer is :

    (1) HgO (2) $K_2Cr_2O_7$ (3) $Ni(CO)_4$ (4) $\left[Ni(H_2O)_6\right]^{2+}$

35. Among the following complexes, which would show the strong Jahn-Teller distortion ?

    (1) $\left[Cr(H_2O)_6\right]^{2+}$ (2) $\left[Ti(H_2O)_6\right]^{3+}$ (3) $\left[Co(H_2O)_6\right]^{2+}$ (4) $\left[Fe(H_2O)_6\right]^{2+}$

36. The homogeneous catalyst used in the hydroformylation or hydrocarbonylation is based on :

    (1) Co (2) Cr (3) Ti (4) V

37. The correct order of the soft character (as per HSAB principle) of the central metal ion is :

    (1) $\left[CrCl_4\right]^- < \left[Cr(bipy)_3\right] < \left[CrO_4\right]^{2-} < \left[Cr(CO)_5\right]^{2-}$

    (2) $\left[CrCl_4\right]^- < \left[CrO_4\right]^{2-} < \left[Cr(CO)_5\right]^{2-} < \left[Cr(bipy)_3\right]$

    (3) $\left[CrO_4\right]^{2-} < \left[CrCl_4\right]^{2-} < \left[Cr(bipy)_2\right] < \left[Cr(CO)_5\right]^{2-}$

    (4) $\left[CrO_4\right]^{2-} < \left[Cr(CO)_5\right]^{2-} < \left[CrCl_4\right]^{2-} < \left[Cr(bipy)_3\right]$

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38. Lewis acidity of BMe_3, BPh_3 and BCl_3 wrt pyridine follows the order :

(1) $BCl_3 > BPh_3 > BMe_3$

(2) $BMe_3 > BPh_3 > BCl_3$

(3) $BPh_3 > BCl_3 > BMe_3$

(4) $BCl_3 > BMe_3 > BPh_3$

39. A disaccharide that will not give Benedict's test and will not form osazone is :

(1) maltose

(2) lactose

(3) cellobiose

(4) sucrose

40. Polarographic method of analysis to obtain individual amounts of Cu^{2+} and Cd^{++} in a given mixture of the two ions (Cu^{2+} and CCl^{2+}) is achieved by measuring their :

(1) half wave potentials

(2) migration current

(3) decomposition potentials

(4) diffusion current

41. Mg^{2+} is prefered in photosynthesis by chlorophyll because :

(1) It has strong spin orbit coupling

(2) It has weak spin orbit coupling

(3) It is a heavy metal

(4) It is high reactive metal

42. A compound contains atoms A, B and C. The oxidation number of A is +2, of B is +5 and C is –2. The possible formula of the compound is :

(1) ABC_2

(2) $B_2(AC_3)_2$

(3) $A_3(BC_4)_2$

(4) $A_3(B_4C)_2$

43. Which among the followings is microwave inactive ?

(1) NO

(2) Br_2

(3) CO

(4) C_2H_4

44. Which of the following species does not obey Huckel Rule ?

(1) cyclopentadienyl anion

(2) cyclopentadienyl cation

(3) cyclopropane cation

(4) Tropylium cation

45. Write the increasing order of relative basicity of the amine, imine and nitrile :

(1) amine > imine > nitrile

(2) imine > nitrile > amine

(3) nitrile > amine > imine

(4) nitrile < imine < amine

46. Which among the following has highest P-O stretching frequency ?

(1) $(CH_3)_3PO$

(2) Br_3PO

(3) Cl_3PO

(4) F_3PO

47. The oxide of chlorine, which is a mixed anhydride ?

    (1) Cl_2O (2) ClO_2 (3) Cl_2O_3 (4) Cl_2O_7

48. Which reagent is used for the conversion of benzyl to benilic acid ?

    (1) Conc. HCl (2) Conc. KOH (3) $TiCl_4$ (4) $KMnO_4$

49. Which in the correct order of vapour pressure of 0.1 M aqueous solution of $FeCl_3$, $NaCl$, $CaCl_2$ and Glucose ?

    (1) Glucose $> NaCl > CaCl_2 > FeCl_3$ (2) $NaCl > CaCl_2 > FeCl_3 >$ Glucose

    (3) $NaCl >$ Glucose $> CaCl_2 > FeCl_3$ (4) $FeCl_3 > CaCl_2 > NaCl >$ Glucose

50. Phenol associates in benzene to form dimer. The Van't Hoff's factor is 0.54. What is the degree of association ?

    (1) 0.46   (2) 0.54   (3) 0.88   (4) 0.92

51. The decreasing order of the reactivity towards electrophiles :
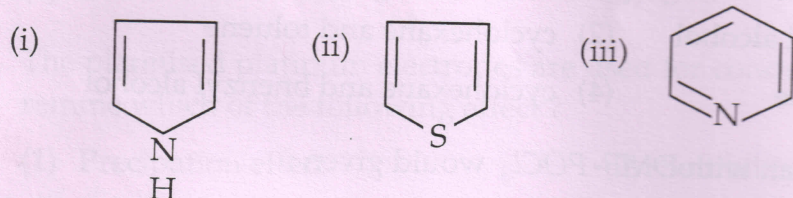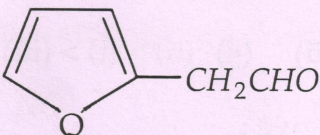
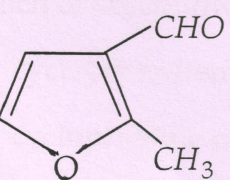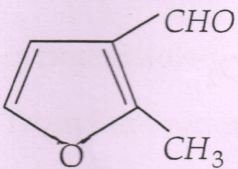   (i)   (ii)   (iii)

    (1) (iii) > (ii) > (i)   (2) (i) > (ii) > (iii)   (3) (iii) > (i) > (ii)   (4) (ii) > (i) > (iii)

52. Pyridine undergoes nitration at elevated temperature to give :

    (1)   (2)
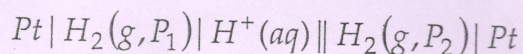
    (3)   (4)
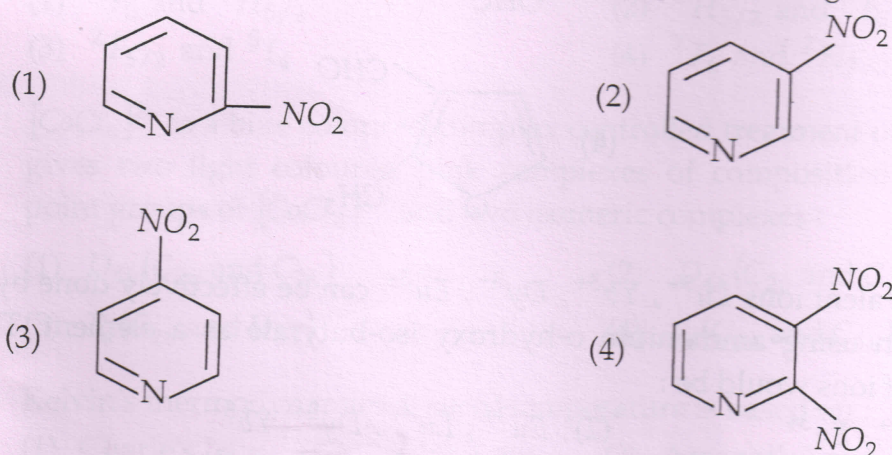
53. Which of the following will not undergo HVZ reaction ?

(1) Acetic acid

(2) Propanoic acid

(3) 2-methyl propanoic acid

(4) 2,2-diemthyl propanoic acid

54. In the Lassaignes's test, the blood red colouration is due to the formation of :

(1) $Fe(CN)_2$

(2) $NaCNS$

(3) $Fe(CNS)_3$

(4) NH_4CNS

55. Conversion of $C_6H_5CN \rightarrow C_6H_5COCH_3$ can be achieved most easily with :

(1) CH_3MgBr followed by hydrolysis

(2) $I_2/NaOH; CH_3I$

(3) $LiAlH_4$ followed by the reaction CH_3I

(4) dil $H_2SO_4 + CH_2N_2$

56. Cyclohexyl benzyl ether when reacted with hydrogen in the presence of 10% palladium on charcoal generates a mixture of :

(1) cyclohexanol and benzyl alcohol

(2) cyclohexane and toluene

(3) cyclohexanol and toluene

(4) cyclohexane and bnenzyl alcohol

57. The reaction of 2-methyl furan with DMF-$POCl_3$ would given :

(1) CH_2CHO

(2) OHC ... CH_3

(3) CHO ... CH_3

(4) CHO ... CH_3

58. The separation of trivalent ions Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+} can be effectively done by a cation exchange resin using ammonium o-hydroxy iso-butyrate as a element. The order of separation of ions would be :

(1) Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+}

(2) Eu^{3+}, Lu^{3+}, Dy^{3+}, Yb^{3+}

(3) Yb^{3+}, Dy^{3+}, Eu^{3+}, Lu^{3+}

(4) Dy^{3+}, Yb^{3+}, Eu^{3+}, Lu^{3+}

59. The symmetry elements present in BF_3 are :
(1) C_3, $3C_2$, S_2, σ_v
(2) C_3, σ_h, σ_v, i
(3) C_3, σ_v, σ_h, $3C_2$
(4) C_3, $3C_2$, σ_x, σ_h

60. The compressibility factor of Vander Waals gas at critical state is :
(1) 1/3
(2) 3/8
(3) 8/27
(4) 3

61. The strong field in $[Fe(CN)_6]^{3-}$ will split the 3d orbitals. Their separation may be observed in the spectroscopy of :
(1) NMR
(2) ESR
(3) IR
(4) Electronic absorption

62. Movement of nuclei is negligible during time taken by an electronic transition is called :
(1) Franck Condon Principle
(2) Lambert Beer Law
(3) Born-Oppenheimer approximation
(4) None

63. The number of ESR peak(s) expected for ^{14}N is (are) :
(1) 1
(2) 2
(3) 3
(4) 4

64. The platinised platinum electrodes are used for conducting measurements in order to remme which of the following effect ?
(1) Precipation effect
(2) Solubility effect
(3) Polarisation effect
(4) Redox effect

65. The ground state term of Sm^{3+} and Eu^{2+} respectively are :
(1) $^7F_0$ and $^6H_{5/2}$
(2) $^6H_{5/2}$ and $^7F_0$
(3) $^2F_{5/2}$ and $^5I_4$
(4) $^7F_6$ and $^2H_{7/2}$

66. $[CoCl_4]^{2-}$ is a blue coloured complex controlled treatment of this complex with water gives two light coloured pink complexes of composition $[Co(H_2O)_4Cl_2]$. Identify point groups of $[CoCl_4]^{2-}$ and two isomeric complexes :
(1) $D_{4h}(C_{2v}$ and $C_{2h})$
(2) $D_{4h}(C_{2v}$ and $C_{4h})$
(3) $T_d(C_{2v}$ and $D_{4h})$
(4) $T_d(C_{2v}$ and $C_{4h})$

67. Kelvin's thermodynamics scale of temperature is based on :
(1) Charle's Law
(2) Joule's Law
(3) Amagat's Law
(4) Carnot's principle

68. Calculate the work of expansion when 2 moles of an ideal gas expands isothermally and reversibly from 10 L to 20 L at 300 K :

(1) 826.5 cal   (2) 413.25 cal   (3) −826.5 cal   (4) −413.25 cal

69. Which of the following is strongest reducing agent ?

(1) $GeCl_2$ (2) $SnCl_2$ (3) $PbCl_2$ (4) $SnCl_4$

70. The total pressure for the reaction $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ under the equilibrium condition is 15 atms. The value of Kp is :

(1) 16   (2) 2   (3) 20   (4) 25

71. When the particle is in its lowest energy state, the average momentum ($<p_x>$) of the particle is :

(1) $<p_x> = 0$ (2) $<p_x> = \dfrac{h}{a}$

(3) $<p_x> = \dfrac{h}{2a}$ (4) $<p_x> = \dfrac{h}{2\pi a}$

72. Which of the following statement is *not* true for haemoglobin ?
(1) The binding with oxygen is weaker in comparison with myoglobin
(2) Iron is 5-coordinated
(3) Iron is coplanar with prorphyrin ring in the absence of oxygen
(4) The oxidation state of iron is +2

73. How many minutes are required to deliver 3.21×10^6 coulombs using a current of 500 amperes used in the production of chlorine ?

(1) 8.3   (2) 10×10^3 (3) 6420   (4) 107

74. A solution containing H^+ and D^+ ions is in equilibrium with a mixture of H_2 and D_2 gases at 25°C. If the partial pressure of both gases are 1.0 atm, find the ratio of $[D^+]/[H^+]$:   (Given : $E^\circ_{D^+/D_2} = -0.003$ V)

(1) 1.23   (2) 1.12   (3) 0.11   (4) 1.0

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75. What will be the emf for a given cell ?

$$Pt \mid H_2(g, P_1) \mid H^+(aq) \parallel H_2(g, P_2) \mid Pt$$

(1) $\dfrac{RT}{F} \ln \dfrac{P_1}{P_2}$

(2) $\dfrac{RT}{F} \ln \dfrac{P_2}{P_1}$

(3) $\dfrac{RT}{2F} \ln \dfrac{P_1}{P_2}$

(4) None of these

76. How much ethyl alcohol must be added to 1.0 L of water so that solution will not freeze at $-4°F$ ($K_f = 1.86°C/m$)

(1) < 20 g (2) < 10.75 g (3) < 494.5 g (4) > 494.5 g

77. When mercuric iodide is added to the aqueous solution of KI, then :

(1) freezing point is raised

(2) freezing point is lowered

(3) freezing point does not change

(4) boiling point does not change

78. In the spinel structure, oxides ions are ccp whereas 1/8th of tetrahedral voids are occupied by A^{2+} and 1/2 of octahedral voids are occupied by B^{3+}. The general formula of the compound is :
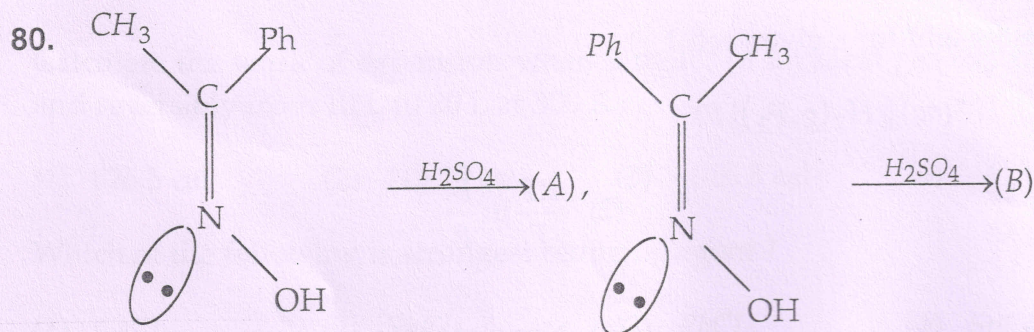
(1) $A_2B_2O_4$ (2) AB_2O_4 (3) $A_2B_4O_2$ (4) $A_4B_2O_2$

79. On adding $AgNO_3$ solution into KI solution, a negatively charged colloidal sol is obtained when they are in :

(1) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.01 M KI

(2) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.1 M KI

(3) 50 mL of 0.2 M $AgNO_3$ + 50 mL of 0.1 M KI

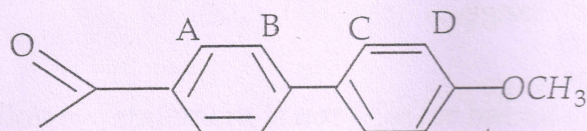(4) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.2 M KI

80.

$$CH_3 \quad Ph$$

$$\xrightarrow{H_2SO_4} (A), \qquad \xrightarrow{H_2SO_4} (B)$$

$$Ph \quad CH_3$$

Product (A) and (B) respectively are :

(1) $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-NHCH_3$, $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-NHCH_3$ (2) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-NHPh$, $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-NHPh$

(3) $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-NHCH_3$, $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-NHPh$ (4) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-NHPh$, $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-NHCH_3$

81. On which position the attack of nitronium ion would be most rapid, when the compound undergoes nitration with HNO_3 / H_2SO_4

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

82. Which of the following pair gives same phenyl osazone ?

(1) D-glucose and D-allose

(2) D-glucose and D-alfrose

(3) D-glucose and D-mannose

(4) D-glucose and D-talose

83. Stereoisomers of aldoheptose is (a) and stereoisomers of ketoheptose is (b). Ratio of a/b is :

(1) $\dfrac{1}{2}$ (2) $\dfrac{2}{1}$ (3) $\dfrac{4}{1}$ (4) $\dfrac{1}{4}$

84. The IUPAC name of the following compound is :
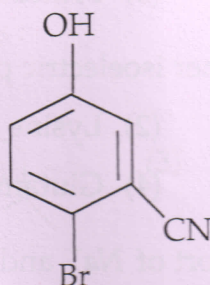
(1) 4-Bromo-3-Cyano phenol

(2) 2-Bromo-5-hydroxybenzonitrile

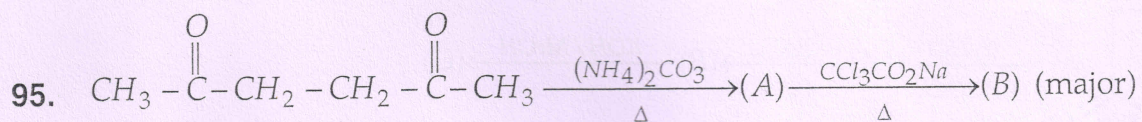(3) 2-Cyano-4-hydroxy bromobenzene

(4) 6-Bromo-3-hydroxybenzonitrile

85. Which is correct matching of **List-I** and **List-II** ?

List-I	List-II
(Quantity measured and variable controlled	(Name of method)
(i) 1/R Vs. Volume of titrant	(A) Amperometeric titrations
(ii) i Vs. Volume of titrant, ε	(B) Potentiometric titrations
(iii) E Vs. Volume of titrant, i = 0	(C) Conductometric titrations

(1) (i) – B, (ii) – C, (iii) – A   (2) (i) – A, (ii) – B, (iii) – C

(3) (i) – C, (ii) – A, (iii) – B   (4) (i) – C, (ii) – B, (iii) – A
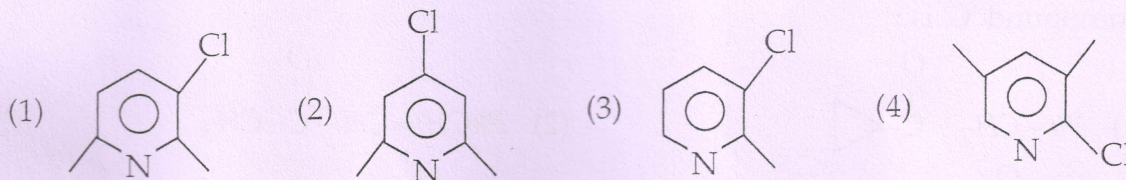
86. Cyctochrom is :

(1) oxygen storage protein   (2) redox protein

(3) Cu – containing protein   (4) Mo containing protein
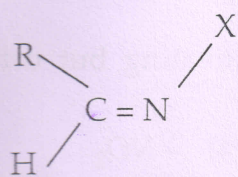
87. Which of the following enzyme causes breakdown of proteins to peptides ?

(1) Lipase   (2) Amylase   (3) Proteases   (4) Peptidases

88. Which of the following will have higher isoelectric point ?

(1) Glycine   (2) Lysine

(3) Aspartic acid   (4) Glutamic acid

89. The ion channels those permit transport of Na^+ and K^+ ions, are constructed from :

(1) globular proteins   (2) helical protiens

(3) pleated proteins   (4) None of these

90. Sulphur is not a constituent of :

(1) Cysteine   (2) Methionine   (3) Ferredoxin   (4) Pyridoxine

91. Molecule having non polar as well as polar bonds but the molecule as a whole is polar :

(1) $(SCN)_2$ (2) Cl_2O_8 (3) B_2Cl_4 (4) I_2Cl_6

92. Among the following compounds which on heating do not produce N_2 ?

(1) $NH_4Cl + CaO$ (2) $(NH_4)_2 Cr_2O_7$ (3) $Ba(N_3)_2$ (4) $NH_4Cl + NaNO_2$

93. Non-metal 'M' forms MCl_3, M_2O_5 and Mg_3M_2 but does not form MI_5. The incorrect statement regarding non-metal is :

(1) 'M' can form multiple bonds

(2) Atomicity of 'M' is 4

(3) 'M' is second period element

(4) The range of oxidation number for M is +5 to –3

94. Which of the following order is correct ?

(1) $K^+ < Ca^{++} < P^{3-} < S^{2-}$: ionic size

(2) $Na^+(aq) > K^+(aq) > Rb^+(aq) > Cs^+(aq)$: electrical conductance

(3) $Al^{3+}(aq) > Mg^{2+}(aq) > Na^+(aq)$: hydrate size

(4) $I^-(aq) < Br^-(aq) < Cl^-(aq) < F^-(aq)$: ionic mobility

95. $CH_3 - \overset{O}{\overset{\|}{C}} - CH_2 - CH_2 - \overset{O}{\overset{\|}{C}} - CH_3 \xrightarrow[\Delta]{(NH_4)_2CO_3} (A) \xrightarrow[\Delta]{CCl_3CO_2Na} (B)$ (major)

Product (B) of above reaction is :

(1)

(2)

(3)

(4)

96.

where X = CH_3COO^-, $Cl-CH_2COO^-$, $PhSO_3^-$

                   (i)   (ii)   (iii)

Rate of reaction toward Beckmann rearrangement :

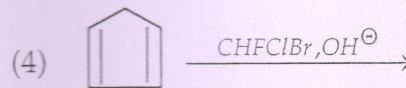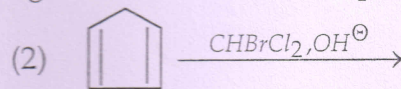(1) (i) > (ii) > (iii)

(2) (ii) > (i) > (iii)

(3) (iii) > (ii) > (i)

(4) (iii) > (i) > (ii)

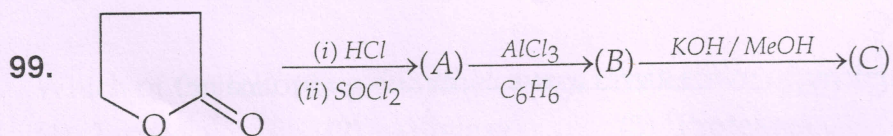**97.** Which of the following reaction, does not give chlorobenzen as a product ?

(1) $\xrightarrow{CHCl_3, OH^\ominus}$

(2) $\xrightarrow{CHBrCl_2, OH^\ominus}$

(3) $\xrightarrow{CHBr_2Cl, OH^\ominus}$

(4) $\xrightarrow{CHFClBr, OH^\ominus}$

98. $Ph - \overset{O}{\underset{14}{\overset{\|}{C}}} - CHN_2 \xrightarrow[H_2O]{Ag_2O} A$, Product 'A' is :

(1) $Ph^{14}CH_2COOH$

(2) $PhCH_2{}^{14}COOH$

(3) $Ph^{14}COOH$

(4) $PhCOOH$

99. $\xrightarrow[\text{(ii) } SOCl_2]{\text{(i) } HCl}$ (A) $\xrightarrow[C_6H_6]{AlCl_3}$ (B) $\xrightarrow{KOH/MeOH}$ (C)

Compound 'C' is :

(1) $Ph-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}\triangleleft$

(2) $PhCH=CH-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$

(3) $Ph-\overset{\overset{\displaystyle O}{\|}}{C}\triangleleft$

(4) $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-CH=CH-CH_3$
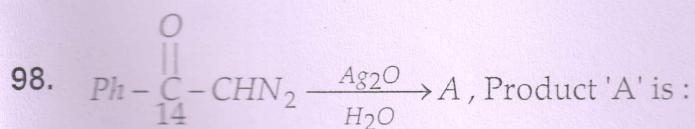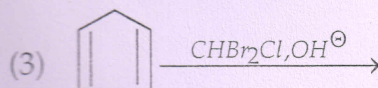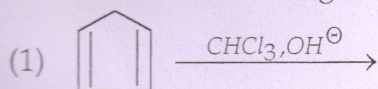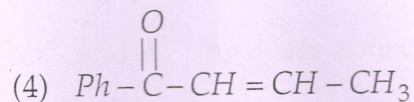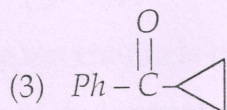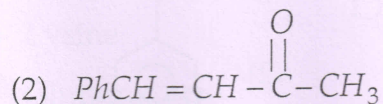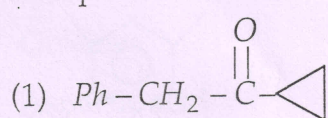
100. Which of the following benzene ring substituents is deactivating but ortho-para directing ?

(1) $-N=O$ (2) $-OCH_3$ (3) $-COCH_3$ (4) $-NO_2$
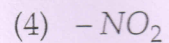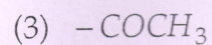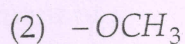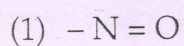
(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

M.Phil./Ph.D./URS-EE-Oct.-2017

SUBJECT : Chemistry

| B |

10054

Sr. No. ....

Time : **1¼ Hours**   Max. Marks : **100**   Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____   Father's Name_____

Mother's Name_____   Date of Examination_____

_____   _____
(Signature of the Candidate)   (Signature of the Invigilator)

SEAL

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. *All questions are compulsory.*

2. The candidates *must return* the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.

3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.

4. The candidate *must not* do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers *must not* be ticked in the question booklet.

5. *There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.*

6. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.

7. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.*

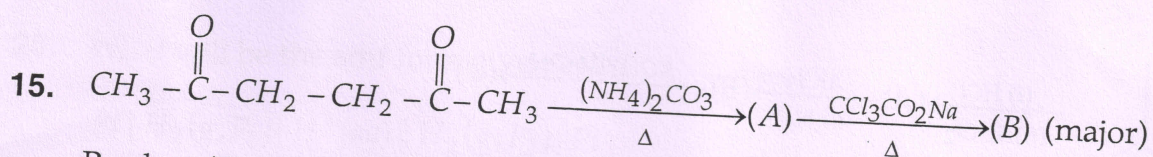M.Phil./Ph.D./URS-EE-Oct.-2017/(Chemistry)/(B)

1. If k_{sp} is the solubility product of a Sparingly soluble salt $A_3 X_2$, then its solubility is :

   (1) $(k_{sp}/108)^{1/5}$ (2) $(k_{sp}/72)^{1/5}$ (3) $(k_{sp})^{1/5}$ (4) $(k_{sp})^{1/2}$

2. The radioactive isotope used to locate brain tumors is :

   (1) $_1^2 D$ (2) $_7^{15} N$ (3) $_{53}^{113} I$ (4) $_6^{13} C$

3. The Bronsted acidity of boron hydrides follows the trend :

   (1) $B_2 H_6 > B_4 H_{10} > B_5 H_9 > B_{10} H_{14}$

   (2) $B_5 H_9 > B_4 H_{10} > B_2 H_6 > B_{10} H_{14}$

   (3) $B_2 H_6 = B_4 H_{10} > B_5 H_9 = B_{10} H_{14}$

   (4) $B_{10} H_{14} > B_5 H_9 > B_4 H_{10} > B_2 H_6$

4. The free energy change (ΔG) of 1 mole of ideal gas which is compressed isothermally from 1 atm to 2 atm is :

   (1) $-RT \ln 2$ (2) RT (3) $RT \ln 2$ (4) $-RT$

5. Among the following, the system that would require least amount of thermal energy to bring its temperature to 80°C is :

   (1) 200 g of water at 40°C (2) 300 g of water at 30°C

   (3) 100 g of water at 20°C (4) 150 g of water at 50°C

6. The point group symmetry of p-dichlorobenzene is :

   (1) C_{2v} (2) D_{2h} (3) D_3 (4) C_{2h}

7. A certain buffer solution contains equal concentrations of A^- and HA. The kb for A^- is 10^{-10}. The pH of solution is :

   (1) 7 (2) 10 (3) 4 (4) 14

8. The spontaneity of a reaction can be judged from the sign of emf (E) and free energy change (G) of the cell :

   (1) $\Delta G = +ve, E = -ve$ (2) $\Delta G = 0, E = 0$

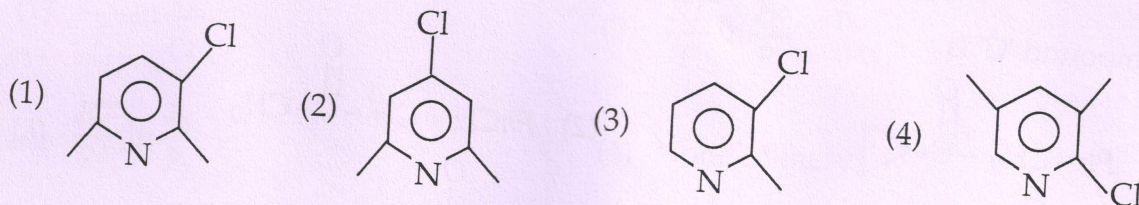   (3) $\Delta G = -ve, E = +ve$ (4) $\Delta G = -ve, E = -ve$

9. An aqueous solution is prepared by mixing equal volume of 0.1 M KCl and 0.1 M KI. To this solution a drop of 0.01 M $AgNO_3$ solution is added. Which of the following is correct ?

   (1) A precipitate forms which is primarily AgI

   (2) A precipitate forms which is primarily $AgCl$

   (3) A precipitate forms which is primarily AgI and $AgCl$

   (4) There will be no precipitation as there is no common ions between potassium and silver salts

10. An example of a colligative property is :

   (1) Vapour pressure   (2) Freezing point

   (3) Osmotic pressure   (4) All

11. Molecule having non polar as well as polar bonds but the molecule as a whole is polar :

   (1) $(SCN)_2$ (2) Cl_2O_8 (3) B_2Cl_4 (4) I_2Cl_6

12. Among the following compounds which on heating do not produce N_2 ?

   (1) $NH_4Cl + CaO$ (2) $(NH_4)_2Cr_2O_7$ (3) $Ba(N_3)_2$ (4) $NH_4Cl + NaNO_2$

13. Non-metal 'M' forms MCl_3, M_2O_5 and Mg_3M_2 but does not form MI_5. The incorrect statement regarding non-metal is :

   (1) 'M' can form multiple bonds

   (2) Atomicity of 'M' is 4

   (3) 'M' is second period element

   (4) The range of oxidation number for M is +5 to –3

14. Which of the following order is correct ?

   (1) $K^+ < Ca^{++} < P^{3-} < S^{2-}$: ionic size

   (2) $Na^+(aq) > K^+(aq) > Rb^+(aq) > Cs^+(aq)$: electrical conductance

   (3) $Al^{3+}(aq) > Mg^{2+}(aq) > Na^+(aq)$: hydrate size

   (4) $I^-(aq) < Br^-(aq) < Cl^-(aq) < F^-(aq)$: ionic mobility

15.

$$CH_3 - \overset{\overset{O}{\|}}{C} - CH_2 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3 \xrightarrow[\Delta]{(NH_4)_2CO_3} (A) \xrightarrow[\Delta]{CCl_3CO_2Na} (B) \text{ (major)}$$
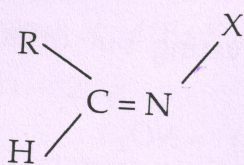
Product (B) of above reaction is :

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

16.

where X = CH_3COO^-, $Cl-CH_2COO^-$, $PhSO_3^-$

(i)   (ii)   (iii)

Rate of reaction toward Beckmann rearrangement :

(1) (i) > (ii) > (iii)

(2) (ii) > (i) > (iii)

(3) (iii) > (ii) > (i)

(4) (iii) > (i) > (ii)

17. Which of the following reaction, does not give chlorobenzen as a product ?

(1) $\xrightarrow{CHCl_3, OH^\ominus}$

(2) $\xrightarrow{CHBrCl_2, OH^\ominus}$

(3) $\xrightarrow{CHBr_2Cl, OH^\ominus}$

(4) $\xrightarrow{CHFClBr, OH^\ominus}$

18. $Ph - \overset{\overset{O}{\|}}{\underset{14}{C}} - CHN_2 \xrightarrow[H_2O]{Ag_2O} A$, Product 'A' is :

(1) $Ph^{14}CH_2COOH$

(2) $PhCH_2{}^{14}COOH$

(3) $Ph^{14}COOH$

(4) $PhCOOH$

4

19.

$$\text{(i) } HCl \atop \text{(ii) } SOCl_2 \longrightarrow (A) \xrightarrow[C_6H_6]{AlCl_3} (B) \xrightarrow{KOH/MeOH} (C)$$

Compound 'C' is :

(1) $Ph-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}\mathord{-}\triangle$

(2) $PhCH=CH-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$

(3) $Ph-\overset{\overset{\displaystyle O}{\|}}{C}\mathord{-}\triangle$

(4) $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-CH=CH-CH_3$
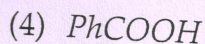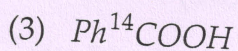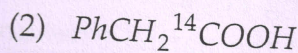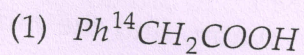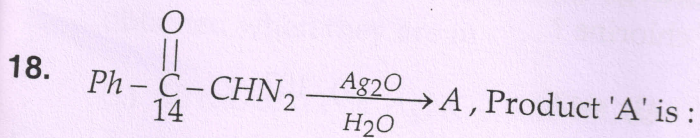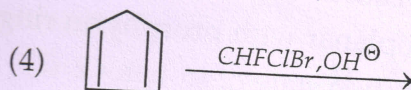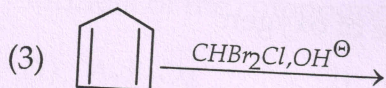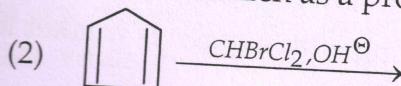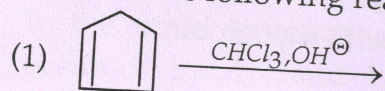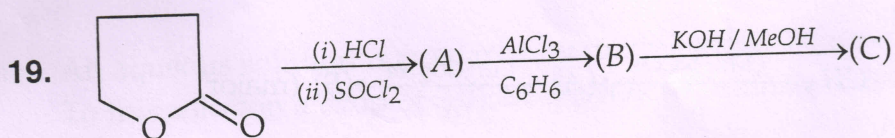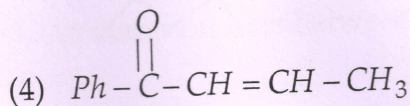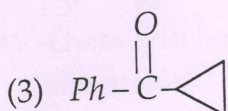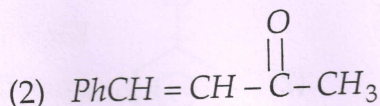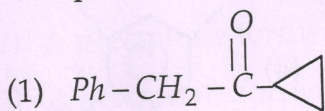
20. Which of the following benzene ring substituents is deactivating but ortho-para directing ?

(1) $-N=O$ (2) $-OCH_3$ (3) $-COCH_3$.(4) $-NO_2$

21. When the particle is in its lowest energy state, the average momentum ($<p_x>$) of the particle is :

(1) $<p_x> = 0$

(2) $<p_x> = \dfrac{h}{a}$

(3) $<p_x> = \dfrac{h}{2a}$

(4) $<p_x> = \dfrac{h}{2\pi a}$

22. Which of the following statement is *not* true for haemoglobin ?

(1) The binding with oxygen is weaker in comparison with myoglobin

(2) Iron is 5-coordinated

(3) Iron is coplanar with prorphyrin ring in the absence of oxygen

(4) The oxidation state of iron is +2

23. How many minutes are required to deliver 3.21×10^6 coulombs using a current of 500 amperes used in the production of chlorine ?

(1) 8.3   (2) 10×10^3 (3) 6420   (4) 107

24. A solution containing H^+ and D^+ ions is in equilibrium with a mixture of H_2 and D_2 gases at 25°C. If the partial pressure of both gases are 1.0 atm, find the ratio of $[D^+]/[H^+]$:   (Given : $E^\circ_{D^+/D_2} = -0.003$ V)

(1) 1.23   (2) 1.12   (3) 0.11   (4) 1.0

25. What will be the emf for a given cell ?

$$Pt \mid H_2(g, P_1) \mid H^+(aq) \parallel H_2(g, P_2) \mid Pt$$
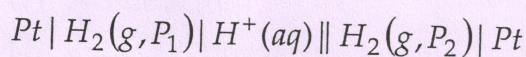
(1) $\dfrac{RT}{F} \ln \dfrac{P_1}{P_2}$

(2) $\dfrac{RT}{F} \ln \dfrac{P_2}{P_1}$

(3) $\dfrac{RT}{2F} \ln \dfrac{P_1}{P_2}$

(4) None of these

26. How much ethyl alcohol must be added to 1.0 L of water so that solution will not freeze at $-4°F$ ($K_f = 1.86°C/m$)

(1) < 20 g   (2) < 10.75 g   (3) < 494.5 g   (4) > 494.5 g

27. When mercuric iodide is added to the aqueous solution of KI, then :

(1) freezing point is raised

(2) freezing point is lowered

(3) freezing point does not change

(4) boiling point does not change

28. In the spinel structure, oxides ions are ccp whereas 1/8th of tetrahedral voids are occupied by A^{2+} and 1/2 of octahedral voids are occupied by B^{3+}. The general formula of the compound is :

(1) $A_2 B_2 O_4$ (2) $AB_2 O_4$ (3) $A_2 B_4 O_2$ (4) $A_4 B_2 O_2$

29. On adding $AgNO_3$ solution into KI solution, a negatively charged colloidal sol is obtained when they are in :

(1) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.01 M KI

(2) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.1 M KI

(3) 50 mL of 0.2 M $AgNO_3$ + 50 mL of 0.1 M KI

(4) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.2 M KI

B

6

30.

$$\underset{\text{CH}_3}{\underset{|}{\text{C}}} \underset{\text{Ph}}{} \xrightarrow{\text{H}_2\text{SO}_4} (A), \qquad \underset{\text{Ph}}{\underset{|}{\text{C}}} \underset{\text{CH}_3}{} \xrightarrow{\text{H}_2\text{SO}_4} (B)$$

Product (A) and (B) respectively are :

(1) $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$, $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$ (2) $CH_3-\overset{O}{\overset{||}{C}}-NHPh$, $CH_3-\overset{O}{\overset{||}{C}}-NHPh$

(3) $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$, $CH_3-\overset{O}{\overset{||}{C}}-NHPh$ (4) $CH_3-\overset{O}{\overset{||}{C}}-NHPh$, $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$
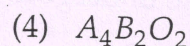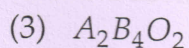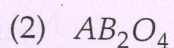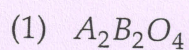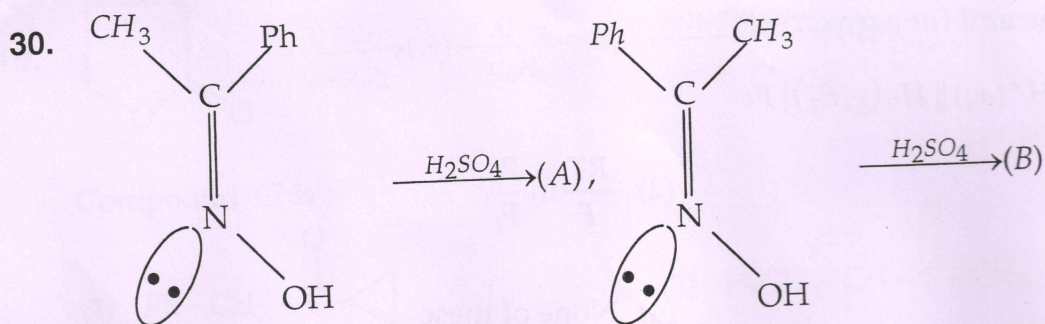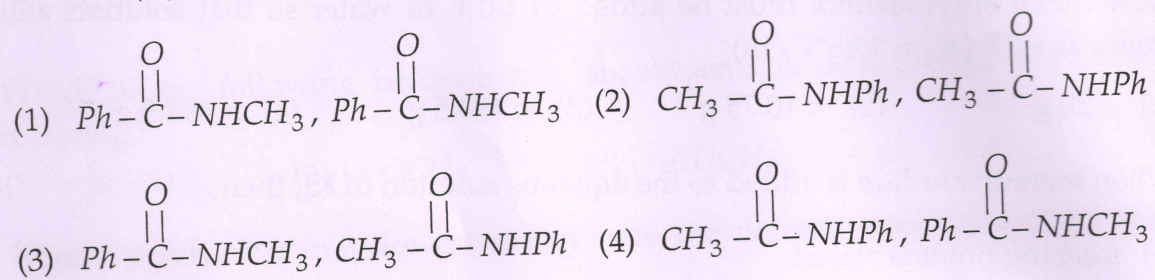
31. The decreasing order of the reactivity towards electrophiles :
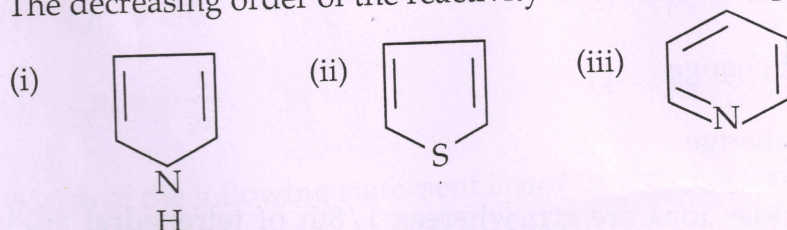
(i)   (ii)   (iii)

(1) (iii) > (ii) > (i)   (2) (i) > (ii) > (iii)   (3) (iii) > (i) > (ii)   (4) (ii) > (i) > (iii)

32. Pyridine undergoes nitration at elevated temperature to give :

(1)   (2)

(3)   (4)

33. Which of the following will not undergo HVZ reaction ?

(1) Acetic acid

(2) Propanoic acid

(3) 2-methyl propanoic acid

(4) 2,2-diemthyl propanoic acid

34. In the Lassaignes's test, the blood red colouration is due to the formation of :

(1) $Fe(CN)_2$

(2) $NaCNS$

(3) $Fe(CNS)_3$

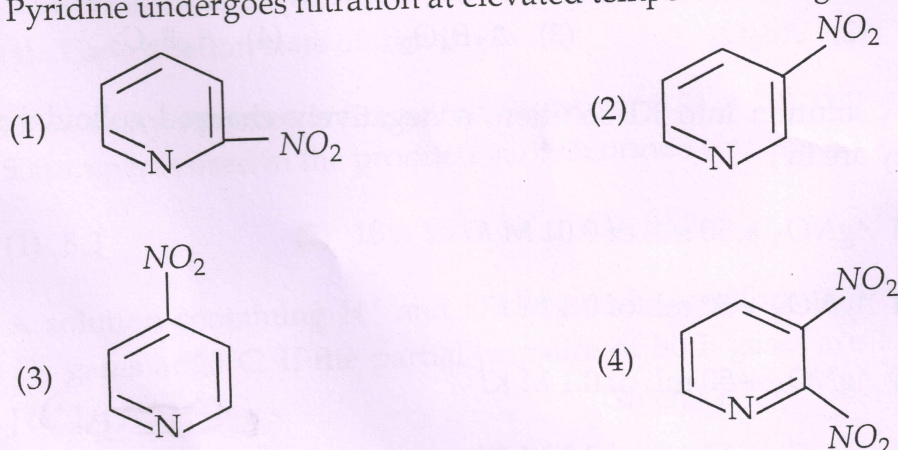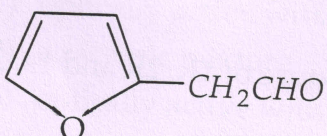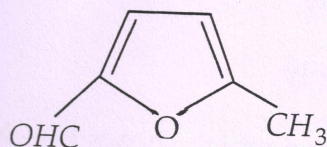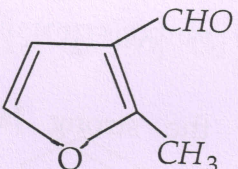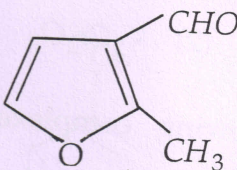(4) NH_4CNS

35. Conversion of $C_6H_5CN \rightarrow C_6H_5COCH_3$ can be achieved most easily with :

(1) CH_3MgBr followed by hydrolysis

(2) $I_2 / NaOH; CH_3I$

(3) $LiAlH_4$ followed by the reaction CH_3I

(4) dil $H_2SO_4 + CH_2N_2$

36. Cyclohexyl benzyl ether when reacted with hydrogen in the presence of 10% palladium on charcoal generates a mixture of :

(1) cyclohexanol and benzyl alcohol

(2) cyclohexane and toluene

(3) cyclohexanol and toluene

(4) cyclohexane and bnenzyl alcohol

37. The reaction of 2-methyl furan with DMF- $POCl_3$ would given :

(1) $\text{furan}-CH_2CHO$

(2) $OHC-\text{furan}-CH_3$

(3) $\text{furan}(CHO)-CH_3$

(4) $\text{furan}(CHO)-CH_3$

38. The separation of trivalent ions Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+} can be effectively done by a cation exchange resin using ammonium o-hydroxy iso-butyrate as a element. The order of separation of ions would be :

(1) Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+}

(2) Eu^{3+}, Lu^{3+}, Dy^{3+}, Yb^{3+}

(3) Yb^{3+}, Dy^{3+}, Eu^{3+}, Lu^{3+}

(4) Dy^{3+}, Yb^{3+}, Eu^{3+}, Lu^{3+}

B

8

39. The symmetry elements present in BF_3 are :

(1) C_3, $3C_2$, S_2, σ_v

(2) C_3, σ_h, σ_v, i

(3) C_3, σ_v, σ_h, $3C_2$

(4) C_3, $3C_2$, σ_x, σ_h

40. The compressibility factor of Vander Waals gas at critical state is :

(1) 1/3   (2) 3/8   (3) 8/27   (4) 3

41. When benzene sulphonic acid and p-nitrophenol are treated with $NaHCO_3$ the gases released, respectively are :

(1) SO_2, NO_2 (2) SO_2, NO (3) CO_2, CO_2 (4) SO_2, CO_2

42. Which of the following pairs give positive Tollen's test ?

(1) Glucose, Sucrose

(2) Glucose, Fructose

(3) Hexanal, Acetophenone

(4) Fructose, Sucrose

43. What configuration are found in the product(s) of the reaction ?
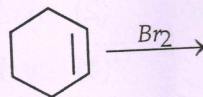
(1) 1s, 2s only

(2) 1R, 2s only

(3) 1R, 2R only

(4) equal mixture of 1R, 2R and 1s, 2s

44. The compound which shows L ← M charge transfer is :

(1) HgO (2) $K_2Cr_2O_7$ (3) $Ni(CO)_4$ (4) $[Ni(H_2O)_6]^{2+}$

45. Among the following complexes, which would show the strong Jahn-Teller distortion ?

(1) $[Cr(H_2O)_6]^{2+}$ (2) $[Ti(H_2O)_6]^{3+}$ (3) $[Co(H_2O)_6]^{2+}$ (4) $[Fe(H_2O)_6]^{2+}$

46. The homogeneous catalyst used in the hydroformylation or hydrocarbonylation is based on :

(1) Co (2) Cr (3) Ti (4) V

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47. The correct order of the soft character (as per HSAB principle) of the central metal ion is :

(1) $[CrCl_4]^- < [Cr(bipy)_3] < [CrO_4]^{2-} < [Cr(CO)_5]^{2-}$

(2) $[CrCl_4]^- < [CrO_4]^{2-} < [Cr(CO)_5]^{2-} < [Cr(bipy)_3]$

(3) $[CrO_4]^{2-} < [CrCl_4]^{2-} < [Cr(bipy)_2] < [Cr(CO)_5]^{2-}$

(4) $[CrO_4]^{2-} < [Cr(CO)_5]^{2-} < [CrCl_4]^{2-} < [Cr(bipy)_3]$

48. Lewis acidity of BMe_3, BPh_3 and BCl_3 wrt pyridine follows the order :

(1) $BCl_3 > BPh_3 > BMe_3$

(2) $BMe_3 > BPh_3 > BCl_3$

(3) $BPh_3 > BCl_3 > BMe_3$

(4) $BCl_3 > BMe_3 > BPh_3$

49. A disaccharide that will not give Benedict's test and will not form osazone is :

(1) maltose (2) lactose (3) cellobiose (4) sucrose

50. Polarographic method of analysis to obtain individual amounts of Cu^{2+} and Cd^{++} in a given mixture of the two ions (Cu^{2+} and CCl^{2+}) is achieved by measuring their :

(1) half wave potentials (2) migration current

(3) decomposition potentials (4) diffusion current

51. R–(–)–2–Bromooctane on reaction with aqueous KOH mainly gives 2-octanol that is :

(1) optically active with 'R' configuration

(2) a racemic mixture

(3) optically active with 'S' configuration

(4) a meso compound

52. The correct order of acidity among :
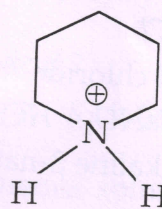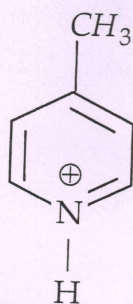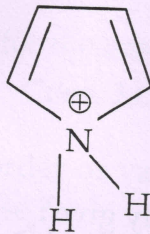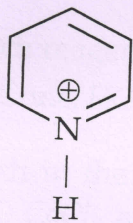
(1) (i) < (ii) < (iii) < (iv)

(2) (iv) < (iii) < (i) < (ii)

(3) (ii) < (i) < (iii) < (iv)

(4) (ii) < (iv) < (i) < (iii)

53. At room temperature, the number of singlet resonance observed in the ^1H spectrum of $Me_3CC(O)NMe_2$ is :

    (1) 3   (2) 4   (3) 5   (4) 2

54. The exceptionally low carbonyl stretching frequency (1650 cm^{-1}) in 2, 4, 6-cycloheptatrienone is due to :

    (1) conjugation effect

    (2) steric effect

    (3) field effect

    (4) electronic effect

55. Conversion of $PhNH_2$ to $PhCN$ can be done by :

    (1) reaction with $NaCN$ in the presence of Ni catalyst

    (2) reaction with $CHCl_3$ and $NaOH$

    (3) diazotization followed by the reaction with $CuCN$

    (4) reaction with ethylformate followed by the reaction with $NaCN$

56. The major product formed in the reaction of anisole with Lithium, liquid ammonia and t-butanol is :

    (1) 1-methoxycyclohexa-1, 3-diene

    (2) 2-methoxycyclohexa-1, 3-diene

    (3) 1-methoxycyclohexa-1, 4-diene

    (4) 3-methoxycyclohexa-1, 4-diene

57. Which of the following molecules have n → π* transition at the lowest wavelength ?

    (1) $HCHO$ (2) $CH_3COC_6H_5$ (3) $CH_3COC_2H_5$ (4) $C_6H_5COC_6H_5$

58. Aniline can be distinguished from methyl amine by its reaction with :

    (1) p-toluene sulphonyl chloride/KOH

    (2) Sn/HCl

    (3) Acetyl chloride

    (4) (i) $NaNO_2/HCl\ 0-5°C$

          (ii) alkaline β-napthol

59. SN^1 reaction on optically active substrates mainly give :

    (1) retention in configuration

    (2) inversion in configuration

    (3) racemic product

    (4) no product

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60. Which among the following is solvolysed at the faster rate ?
   (1) $C_6H_5CH_2Cl$
   (2) Me_3C-Cl
   (3) $CH_2=CH-CH_2Cl$
   (4) $(C_6H_5)_3C-Cl$

61. Mg^{2+} is prefered in photosynthesis by chlorophyll because :
   (1) It has strong spin orbit coupling
   (2) It has weak spin orbit coupling
   (3) It is a heavy metal
   (4) It is high reactive metal

62. A compound contains atoms A, B and C. The oxidation number of A is +2, of B is +5 and C is –2. The possible formula of the compound is :
   (1) ABC_2
   (2) $B_2(AC_3)_2$
   (3) $A_3(BC_4)_2$
   (4) $A_3(B_4C)_2$

63. Which among the followings is microwave inactive ?

   (1) NO
   (2) Br_2
   (3) CO
   (4) C_2H_4

64. Which of the following species does not obey Huckel Rule ?
   (1) cyclopentadienyl anion
   (2) cyclopentadienyl cation
   (3) cyclopropane cation
   (4) Tropylium cation

65. Write the increasing order of relative basicity of the amine, imine and nitrile :
   (1) amine > imine > nitrile
   (2) imine > nitrile > amine
   (3) nitrile > amine > imine
   (4) nitrile < imine < amine

66. Which among the following has highest P-O stretching frequency ?
   (1) $(CH_3)_3PO$
   (2) Br_3PO
   (3) Cl_3PO
   (4) F_3PO

67. The oxide of chlorine, which is a mixed anhydride ?
   (1) Cl_2O
   (2) ClO_2
   (3) Cl_2O_3
   (4) Cl_2O_7

68. Which reagent is used for the conversion of benzyl to benilic acid ?
   (1) Conc. HCl
   (2) Conc. KOH
   (3) $TiCl_4$
   (4) $KMnO_4$

69. Which in the correct order of vapour pressure of 0.1 M aqueous solution of $FeCl_3$, NaCl, $CaCl_2$ and Glucose ?
   (1) Glucose > NaCl > $CaCl_2$ > $FeCl_3$
   (2) NaCl > $CaCl_2$ > $FeCl_3$ > Glucose
   (3) NaCl > Glucose > $CaCl_2$ > $FeCl_3$
   (4) $FeCl_3$ > $CaCl_2$ > NaCl > Glucose

70. Phenol associates in benzene to form dimer. The Van't Hoff's factor is 0.54. What is the degree of association ?

    (1) 0.46   (2) 0.54   (3) 0.88   (4) 0.92

71. The strong field in $[Fe(CN)_6]^{3-}$ will split the 3d orbitals. Their separation may be observed in the spectroscopy of :

    (1) NMR   (2) ESR

    (3) IR   (4) Electronic absorption

72. Movement of nuclei is negligible during time taken by an electronic transition is called :

    (1) Franck Condon Principle   (2) Lambert Beer Law

    (3) Born-Oppenheimer approximation   (4) None

73. The number of ESR peak(s) expected for ^{14}N is (are) :

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

74. The platinised platinum electrodes are used for conducting measurements in order to remme which of the following effect ?

    (1) Precipation effect   (2) Solubility effect

    (3) Polarisation effect   (4) Redox effect

75. The ground state term of Sm^{3+} and Eu^{2+} respectively are :

    (1) $^7F_0$ and $^6H_{5/2}$ (2) $^6H_{5/2}$ and $^7F_0$

    (3) $^2F_{5/2}$ and $^5I_4$ (4) $^7F_6$ and $^2H_{7/2}$

76. $[CoCl_4]^{2-}$ is a blue coloured complex controlled treatment of this complex with water gives two light coloured pink complexes of composition $[Co(H_2O)_4Cl_2]$. Identify point groups of $[CoCl_4]^{2-}$ and two isomeric complexes :

    (1) $D_{4h}(C_{2v}$ and $C_{2h})$

    (3) $T_d(C_{2v}$ and $D_{4h})$

    (2) $D_{4h}(C_{2v}$ and $C_{4h})$

    (4) $T_d(C_{2v}$ and $C_{4h})$

77. Kelvin's thermodynamics scale of temperature is based on :

    (1) Charle's Law   (2) Joule's Law   (3) Amagat's Law   (4) Carnot's principle

78. Calculate the work of expansion when 2 moles of an ideal gas expands isothermally and reversibly from 10 L to 20 L at 300 K :

    (1) 826.5 cal   (2) 413.25 cal   (3) −826.5 cal   (4) −413.25 cal

79. Which of the following is strongest reducing agent ?

    (1) $GeCl_2$ (2) $SnCl_2$ (3) $PbCl_2$ (4) $SnCl_4$

80. The total pressure for the reaction $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ under the equilibrium condition is 15 atms. The value of Kp is :

    (1) 16   (2) 2   (3) 20   (4) 25

81. The ground states of high spin octahedral and tetrahedral Co(II) complexes are respectively :

    (1) $^4T_{2g}$ and $^4A_2$ (2) $^4T_{1g}$ and $^4A_2$ (3) $^3T_{1g}$ and $^4A_2$ (4) $^4T_{1g}$ and $^3T_1$

82. A true statement about base hydrolysis of $\left[Co(NH_3)_5 Cl\right]^{2+}$:

    (1) It is first order reaction

    (2) The rate determining step involves the dissociation of chloride in $\left[Co(NH_3)_4(NH_2)Cl\right]^+$

    (3) The rate is independent of the concentration of the base

    (4) The rate determining step involves the abstraction of a proton from $\left[Co(NH_3)_5 Cl\right]^{2+}$

83. $B_{10}C_2H_{12}$ is isoelectronic with :

    (1) $B_{12}H_{12}^{2-}$ (2) $B_{12}H_{12}$ (3) $B_{12}H_{12}^{2+}$ (4) $B_{12}H_{12}^{4-}$

84. Which of the following is the strongest oxidizing agent ?

    (1) In^{3+} (2) Ga^{3+} (3) Ti^{3+} (4) Al^{3+}

85. Electron transfer from $\left[Fe(H_2O)_6\right]^{2+}$ to $\left[Fe(H_2O)_6\right]^{3+}$ is likely to occur via :

    (1) d-d transition

    (2) inner sphere electron transfer

    (3) SN^1 mechanism

    (4) outer sphere electron transfer

86. The neutral complex which follows 18-electron rule is :

    (1) $\left(\eta^5 - C_5H_5\right)Fe(CO)_2$

    (2) $\left(\eta^5 - C_5H_5\right)Mo(CO)_3$

    (3) $\left(\eta^5 - C_5H_5\right)Co$

    (4) $\left(\eta^5 - C_5H_5\right)Re\left(\eta^5 - C_6H_6\right)$

87. The degree of hydration is expected to the maximum for :

(1) Mg^{2+} (2) Na^+ (3) Ba^{2+} (4) K^+

88. For this system in equilibrium $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ the number of components (C), phases (P) and degree of freedom (F), respectively are :

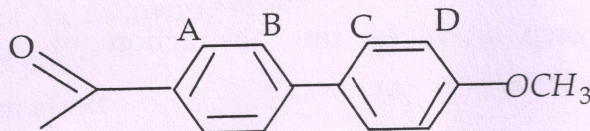(1) 1, 3, 2   (2) 2, 2, 2   (3) 2, 0, 3   (4) 2, 3, 1

89. The compound having highest melting point :

(1) $LiCl$ (2) LiF (3) $LiBr$ (4) LiI

90. The pH of a $1.0 \times 10^{-3} \mu$ solution of a weak acid HA is 4.0. The dissociation constant k_a is :

(1) 1.0×10^{-3} (2) 1.0×10^{-4} (3) 1.0×10^{-5} (4) 1.0×10^{-6}

91. On which position the attack of nitronium ion would be most rapid, when the compound undergoes nitration with HNO_3 / H_2SO_4

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

92. Which of the following pair gives same phenyl osazone ?

(1) D-glucose and D-allose

(2) D-glucose and D-alfrose

(3) D-glucose and D-mannose

(4) D-glucose and D-talose

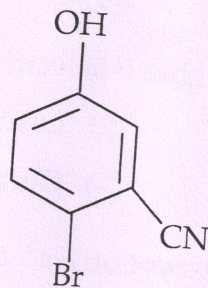93. Stereoisomers of aldoheptose is (a) and stereoisomers of ketoheptose is (b). Ratio of a/b is :

(1) $\dfrac{1}{2}$ (2) $\dfrac{2}{1}$ (3) $\dfrac{4}{1}$ (4) $\dfrac{1}{4}$

B

94. The IUPAC name of the following compound is :

(1) 4-Bromo-3-Cyano phenol

(2) 2-Bromo-5-hydroxybenzonitrile

(3) 2-Cyano-4-hydroxy bromobenzene

(4) 6-Bromo-3-hydroxybenzonitrile

95. Which is correct matching of **List-I** and **List-II** ?

List-I

(Quantity measured and variable controlled

List-II

(Name of method)

(i) $1/R$ Vs. Volume of titrant

(ii) i Vs. Volume of titrant, ε

(iii) E Vs. Volume of titrant, $i = 0$

(A) Amperometeric titrations

(B) Potentiometric titrations

(C) Conductometric titrations

(1) (i) – B, (ii) – C, (iii) – A

(3) (i) – C, (ii) – A, (iii) – B

(2) (i) – A, (ii) – B, (iii) – C

(4) (i) – C, (ii) – B, (iii) – A

96. Cyctochrom is :

(1) oxygen storage protein

(3) Cu – containing protein

(2) redox protein

(4) Mo containing protein

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97. Which of the following enzyme causes breakdown of proteins to peptides ?
    (1) Lipase
    (2) Amylase
    (3) Proteases
    (4) Peptidases

98. Which of the following will have higher isoelectric point ?
    (1) Glycine
    (2) Lysine
    (3) Aspartic acid
    (4) Glutamic acid

99. The ion channels those permit transport of Na^+ and K^+ ions, are constructed from :
    (1) globular proteins
    (2) helical protiens
    (3) pleated proteins
    (4) None of these

100. Sulphur is not a constituent of :
    (1) Cysteine
    (2) Methionine
    (3) Ferredoxin
    (4) Pyridoxine

Total No. of Printed Pages : 17

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M.Phil./Ph.D./URS-EE-Oct.-2017

SUBJECT : Chemistry

C

Sr. No. 10055

Time : 1¼ Hours   Max. Marks : **100**   Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Father's Name_____

Mother's Name_____ Date of Examination_____

_____   _____
(Signature of the Candidate)   (Signature of the Invigilator)

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1. *All questions are compulsory.*

2. The candidates **must return** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.

3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.

4. The candidate **must not** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers **must not** be ticked in the question booklet.

5. *There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.*

6. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.

7. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.*

M.Phil./Ph.D./URS-EE-Oct.-2017/(Chemistry)/(C)

1. Mg^{2+} is prefered in photosynthesis by chlorophyll because :

   (1) It has strong spin orbit coupling   (2) It has weak spin orbit coupling

   (3) It is a heavy metal   (4) It is high reactive metal

2. A compound contains atoms A, B and C. The oxidation number of A is +2, of B is +5 and C is –2. The possible formula of the compound is :

   (1) ABC_2 (2) $B_2(AC_3)_2$ (3) $A_3(BC_4)_2$ (4) $A_3(B_4C)_2$

3. Which among the followings is microwave inactive ?

   (1) NO (2) Br_2 (3) CO (4) C_2H_4

4. Which of the following species does not obey Huckel Rule ?

   (1) cyclopentadienyl anion   (2) cyclopentadienyl cation

   (3) cyclopropane cation   (4) Tropylium cation

5. Write the increasing order of relative basicity of the amine, imine and nitrile :

   (1) amine > imine > nitrile   (2) imine > nitrile > amine

   (3) nitrile > amine > imine   (4) nitrile < imine < amine

6. Which among the following has highest P-O stretching frequency ?

   (1) $(CH_3)_3PO$ (2) Br_3PO (3) Cl_3PO (4) F_3PO

7. The oxide of chlorine, which is a mixed anhydride ?

   (1) Cl_2O (2) ClO_2 (3) Cl_2O_3 (4) Cl_2O_7

8. Which reagent is used for the conversion of benzyl to benilic acid ?

   (1) Conc. HCl (2) Conc. KOH (3) $TiCl_4$ (4) $KMnO_4$

9. Which in the correct order of vapour pressure of 0.1 M aqueous solution of $FeCl_3$, $NaCl$, $CaCl_2$ and Glucose ?

   (1) Glucose > $NaCl$ > $CaCl_2$ > $FeCl_3$ (2) $NaCl$ > $CaCl_2$ > $FeCl_3$ > Glucose

   (3) $NaCl$ > Glucose > $CaCl_2$ > $FeCl_3$ (4) $FeCl_3$ > $CaCl_2$ > $NaCl$ > Glucose

10. Phenol associates in benzene to form dimer. The Van't Hoff's factor is 0.54. What is the degree of association ?

    (1) 0.46   (2) 0.54   (3) 0.88   (4) 0.92

11. R–(–)–2–Bromooctane on reaction with aqueous KOH mainly gives 2-octanol that is :
    (1) optically active with 'R' configuration
    (2) a racemic mixture
    (3) optically active with 'S' configuration
    (4) a meso compound

12. The correct order of acidity among :
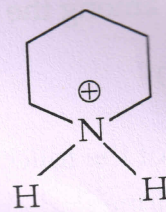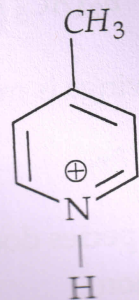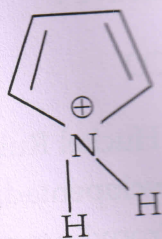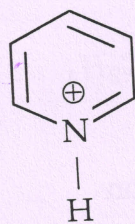
    (1) (i) < (ii) < (iii) < (iv)
    (3) (ii) < (i) < (iii) < (iv)
    (2) (iv) < (iii) < (i) < (ii)
    (4) (ii) < (iv) < (i) < (iii)

13. At room temperature, the number of singlet resonance observed in the ^1H spectrum of $Me_3CC(O)NMe_2$ is :
    (1) 3
    (2) 4
    (3) 5
    (4) 2

14. The exceptionally low carbonyl stretching frequency (1650 cm^{-1}) in 2, 4, 6-cycloheptatrienone is due to :
    (1) conjugation effect
    (2) steric effect
    (3) field effect
    (4) electronic effect

15. Conversion of $PhNH_2$ to $PhCN$ can be done by :
    (1) reaction with $NaCN$ in the presence of Ni catalyst
    (2) reaction with $CHCl_3$ and $NaOH$
    (3) diazotization followed by the reaction with $CuCN$
    (4) reaction with ethylformate followed by the reaction with $NaCN$

16. The major product formed in the reaction of anisole with Lithium, liquid ammonia and t-butanol is :
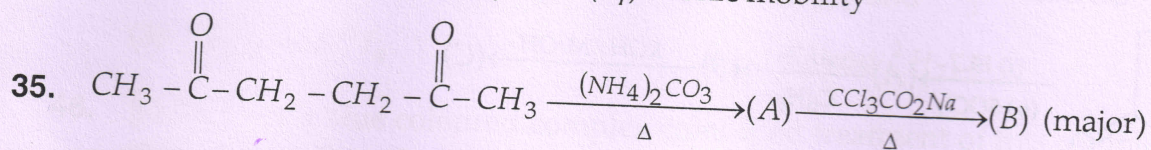   (1) 1-methoxycyclohexa-1, 3-diene
    (2) 2-methoxycyclohexa-1, 3-diene
    (3) 1-methoxycyclohexa-1, 4-diene
    (4) 3-methoxycyclohexa-1, 4-diene

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17. Which of the following molecules have n → π* transition at the lowest wavelength ?

    (1) $HCHO$ (2) $CH_3COC_6H_5$ (3) $CH_3COC_2H_5$ (4) $C_6H_5COC_6H_5$

18. Aniline can be distinguished from methyl amine by its reaction with :

    (1) p-toluene sulphonyl chloride/KOH

    (2) Sn/HCl

    (3) Acetyl chloride

    (4) (i) $NaNO_2 / HCl \ 0 - 5°C$

        (ii) alkaline β-napthol

19. SN^1 reaction on optically active substrates mainly give :

    (1) retention in configuration   (2) inversion in configuration

    (3) racemic product   (4) no product

20. Which among the following is solvolysed at the faster rate ?

    (1) $C_6H_5CH_2Cl$ (2) $Me_3C - Cl$

    (3) $CH_2 = CH - CH_2Cl$ (4) $(C_6H_5)_3C - Cl$

21. The ground states of high spin octahedral and tetrahedral Co(II) complexes are respectively :

    (1) $^4T_{2g}$ and $^4A_2$ (2) $^4T_{1g}$ and $^4A_2$ (3) $^3T_{1g}$ and $^4A_2$ (4) $^4T_{1g}$ and $^3T_1$

22. A true statement about base hydrolysis of $\left[Co(NH_3)_5Cl\right]^{2+}$:

    (1) It is first order reaction

    (2) The rate determining step involves the dissociation of chloride in $\left[Co(NH_3)_4(NH_2)Cl\right]^+$

    (3) The rate is independent of the concentration of the base

    (4) The rate determining step involves the abstraction of a proton from $\left[Co(NH_3)_5Cl\right]^{2+}$

23. $B_{10}C_2H_{12}$ is isoelectronic with :

    (1) $B_{12}H_{12}^{2-}$ (2) $B_{12}H_{12}$ (3) $B_{12}H_{12}^{2+}$ (4) $B_{12}H_{12}^{4-}$

24. Which of the following is the strongest oxidizing agent ?

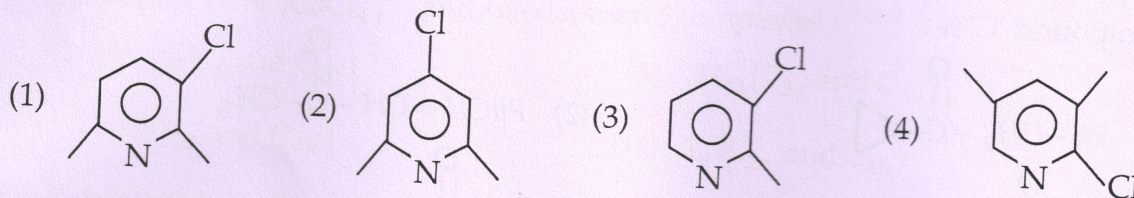   (1) In^{3+} (2) Ga^{3+} (3) Ti^{3+} (4) Al^{3+}

25. Electron transfer from $\left[Fe(H_2O)_6\right]^{2+}$ to $\left[Fe(H_2O)_6\right]^{3+}$ is likely to occur via :

    (1) d-d transition

    (2) inner sphere electron transfer

    (3) SN^1 mechanism

    (4) outer sphere electron transfer

26. The neutral complex which follows 18-electron rule is :

    (1) $\left(\eta^5 - C_5H_5\right)Fe(CO)_2$

    (2) $\left(\eta^5 - C_5H_5\right)Mo(CO)_3$

    (3) $\left(\eta^5 - C_5H_5\right)Co$

    (4) $\left(\eta^5 - C_5H_5\right)Re\left(\eta^5 - C_6H_6\right)$

27. The degree of hydration is expected to the maximum for :

    (1) Mg^{2+}

    (2) Na^+

    (3) Ba^{2+}

    (4) K^+

28. For this system in equilibrium $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ the number of components (C), phases (P) and degree of freedom (F), respectively are :

    (1) 1, 3, 2

    (2) 2, 2, 2

    (3) 2, 0, 3

    (4) 2, 3, 1

29. The compound having highest melting point :

    (1) $LiCl$

    (2) LiF

    (3) $LiBr$

    (4) LiI

30. The pH of a $1.0 \times 10^{-3}\,\mu$ solution of a weak acid HA is 4.0. The dissociation constant k_a is :

    (1) 1.0×10^{-3}

    (2) 1.0×10^{-4}

    (3) 1.0×10^{-5}

    (4) 1.0×10^{-6}

31. Molecule having non polar as well as polar bonds but the molecule as a whole is polar :

    (1) $(SCN)_2$

    (2) Cl_2O_8

    (3) B_2Cl_4

    (4) I_2Cl_6

32. Among the following compounds which on heating do not produce N_2 ?

    (1) $NH_4Cl + CaO$

    (2) $(NH_4)_2Cr_2O_7$

    (3) $Ba(N_3)_2$

    (4) $NH_4Cl + NaNO_2$

33. Non-metal 'M' forms MCl_3, M_2O_5 and Mg_3M_2 but does not form MI_5. The incorrect statement regarding non-metal is :

    (1) 'M' can form multiple bonds

    (2) Atomicity of 'M' is 4

    (3) 'M' is second period element

    (4) The range of oxidation number for M is +5 to –3

34. Which of the following order is correct ?
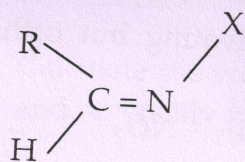
    (1) $K^+ < Ca^{++} < P^{3-} < S^{2-}$: ionic size

    (2) $Na^+(aq) > K^+(aq) > Rb^+(aq) > Cs^+(aq)$: electrical conductance

    (3) $Al^{3+}(aq) > Mg^{2+}(aq) > Na^+(aq)$: hydrate size

    (4) $I^-(aq) < Br^-(aq) < Cl^-(aq) < F^-(aq)$: ionic mobility

35. $$CH_3 - \overset{\overset{O}{\|}}{C} - CH_2 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3 \xrightarrow[\Delta]{(NH_4)_2CO_3} (A) \xrightarrow[\Delta]{CCl_3CO_2Na} (B) \text{ (major)}$$

Product (B) of above reaction is :

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

36.

$$\underset{H}{\overset{R}{>}}C = N - X \qquad \text{where } X = \underset{(i)}{CH_3COO^-}, \ \underset{(ii)}{Cl-CH_2COO^-}, \ \underset{(iii)}{PhSO_3^-}$$
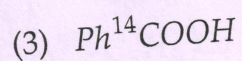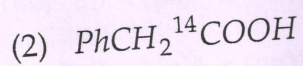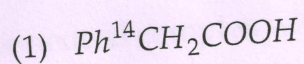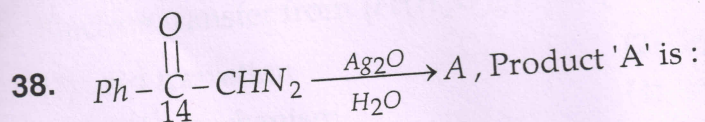
Rate of reaction toward Beckmann rearrangement :

    (1) (i) > (ii) > (iii)   (2) (ii) > (i) > (iii)

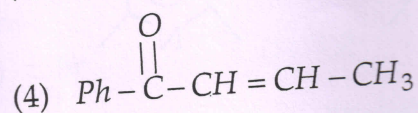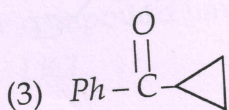   (3) (iii) > (ii) > (i)   (4) (iii) > (i) > (ii)

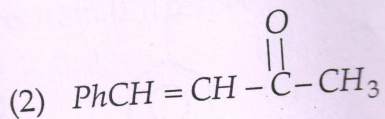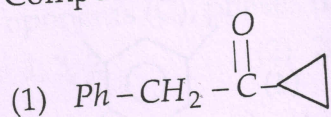**37.** Which of the following reaction, does not give chlorobenzen as a product ?

    (1) $\xrightarrow{CHCl_3, OH^\ominus}$ (2) $\xrightarrow{CHBrCl_2, OH^\ominus}$

    (3) $\xrightarrow{CHBr_2Cl, OH^\ominus}$ (4) $\xrightarrow{CHFClBr, OH^\ominus}$

38. $Ph - \overset{O}{\underset{14}{\overset{||}{C}}} - CHN_2 \xrightarrow[H_2O]{Ag_2O} A$, Product 'A' is :

(1) $Ph^{14}CH_2COOH$

(2) $PhCH_2{}^{14}COOH$

(3) $Ph^{14}COOH$

(4) $PhCOOH$

39.

$\xrightarrow[\text{(ii) } SOCl_2]{\text{(i) } HCl} (A) \xrightarrow[C_6H_6]{AlCl_3} (B) \xrightarrow{KOH/MeOH} (C)$

Compound 'C' is :

(1) $Ph - CH_2 - \overset{O}{\overset{||}{C}} - \triangle$

(2) $PhCH = CH - \overset{O}{\overset{||}{C}} - CH_3$

(3) $Ph - \overset{O}{\overset{||}{C}} - \triangle$

(4) $Ph - \overset{O}{\overset{||}{C}} - CH = CH - CH_3$
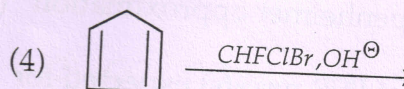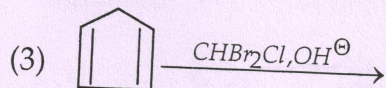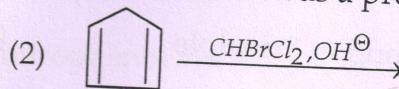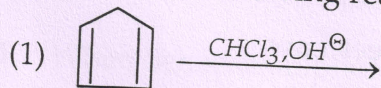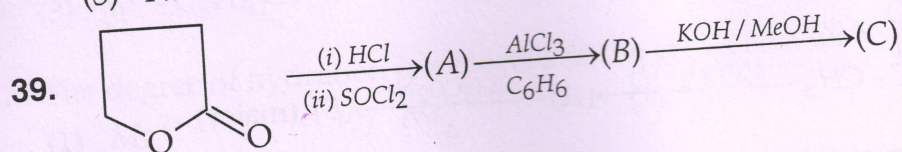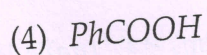
40. Which of the following benzene ring substituents is deactivating but ortho-para directing ?

(1) $- N = O$

(2) $- OCH_3$

(3) $- COCH_3$

(4) $- NO_2$
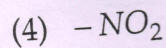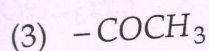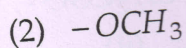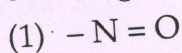
41. The strong field in $[Fe(CN)_6]^{3-}$ will split the 3d orbitals. Their separation may be observed in the spectroscopy of :

(1) NMR

(2) ESR

(3) IR

(4) Electronic absorption

42. Movement of nuclei is negligible during time taken by an electronic transition is called :

(1) Franck Condon Principle

(2) Lambert Beer Law

(3) Born-Oppenheimer approximation

(4) None

**43.** The number of ESR peak(s) expected for ^{14}N is (are) :

(1) 1

(2) 2

(3) 3

(4) 4

C

44. The platinised platinum electrodes are used for conducting measurements in order to remme which of the following effect ?

(1) Precipation effect

(2) Solubility effect

(3) Polarisation effect

(4) Redox effect

45. The ground state term of Sm^{3+} and Eu^{2+} respectively are :

(1) $^7F_0$ and $^6H_{5/2}$

(2) $^6H_{5/2}$ and $^7F_0$

(3) $^2F_{5/2}$ and $^5I_4$

(4) $^7F_6$ and $^2H_{7/2}$

46. $[CoCl_4]^{2-}$ is a blue coloured complex controlled treatment of this complex with water gives two light coloured pink complexes of composition $[Co(H_2O)_4Cl_2]$. Identify point groups of $[CoCl_4]^{2-}$ and two isomeric complexes :

(1) $D_{4h}(C_{2v}$ and $C_{2h})$

(2) $D_{4h}(C_{2v}$ and $C_{4h})$

(3) $T_d(C_{2v}$ and $D_{4h})$

(4) $T_d(C_{2v}$ and $C_{4h})$

47. Kelvin's thermodynamics scale of temperature is based on :

(1) Charle's Law   (2) Joule's Law   (3) Amagat's Law   (4) Carnot's principle

48. Calculate the work of expansion when 2 moles of an ideal gas expands isothermally and reversibly from 10 L to 20 L at 300 K :

(1) 826.5 cal

(2) 413.25 cal

(3) −826.5 cal

(4) −413.25 cal

49. Which of the following is strongest reducing agent ?

(1) $GeCl_2$

(2) $SnCl_2$

(3) $PbCl_2$

(4) $SnCl_4$

50. The total pressure for the reaction $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ under the equilibrium condition is 15 atms. The value of Kp is :

(1) 16

(2) 2

(3) 20

(4) 25

51. When benzene sulphonic acid and p-nitrophenol are treated with $NaHCO_3$ the gases released, respectively are :

(1) SO_2, NO_2

(2) SO_2, NO

(3) CO_2, CO_2

(4) SO_2, CO_2

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52. Which of the following pairs give positive Tollen's test ?

(1) Glucose, Sucrose

(2) Glucose, Fructose

(3) Hexanal, Acetophenone

(4) Fructose, Sucrose

53. What configuration are found in the product(s) of the reaction ?

$\xrightarrow{Br_2}$
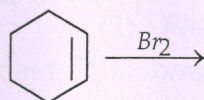
(1) 1s, 2s only

(2) 1R, 2s only

(3) 1R, 2R only

(4) equal mixture of 1R, 2R and 1s, 2s

54. The compound which shows L ← M charge transfer is :

(1) HgO

(2) $K_2Cr_2O_7$

(3) $Ni(CO)_4$

(4) $\left[Ni(H_2O)_6\right]^{2+}$

55. Among the following complexes, which would show the strong Jahn-Teller distortion ?

(1) $\left[Cr(H_2O)_6\right]^{2+}$

(2) $\left[Ti(H_2O)_6\right]^{3+}$

(3) $\left[Co(H_2O)_6\right]^{2+}$

(4) $\left[Fe(H_2O)_6\right]^{2+}$

56. The homogeneous catalyst used in the hydroformylation or hydrocarbonylation is based on :

(1) Co

(2) Cr

(3) Ti

(4) V

57. The correct order of the soft character (as per HSAB principle) of the central metal ion is :

(1) $\left[CrCl_4\right]^- < \left[Cr(bipy)_3\right] < \left[CrO_4\right]^{2-} < \left[Cr(CO)_5\right]^{2-}$

(2) $\left[CrCl_4\right]^- < \left[CrO_4\right]^{2-} < \left[Cr(CO)_5\right]^{2-} < \left[Cr(bipy)_3\right]$

(3) $\left[CrO_4\right]^{2-} < \left[CrCl_4\right]^{2-} < \left[Cr(bipy)_2\right] < \left[Cr(CO)_5\right]^{2-}$

(4) $\left[CrO_4\right]^{2-} < \left[Cr(CO)_5\right]^{2-} < \left[CrCl_4\right]^{2-} < \left[Cr(bipy)_3\right]$

58. Lewis acidity of BMe_3, BPh_3 and BCl_3 wrt pyridine follows the order :

(1) $BCl_3 > BPh_3 > BMe_3$

(2) $BMe_3 > BPh_3 > BCl_3$

(3) $BPh_3 > BCl_3 > BMe_3$

(4) $BCl_3 > BMe_3 > BPh_3$

C

59. A disaccharide that will not give Benedict's test and will not form osazone is :

(1) maltose   (2) lactose   (3) cellobiose   (4) sucrose

60. Polarographic method of analysis to obtain individual amounts of Cu^{2+} and Cd^{++} in a given mixture of the two ions (Cu^{2+} and CCl^{2+}) is achieved by measuring their :

(1) half wave potentials

(2) migration current

(3) decomposition potentials

(4) diffusion current

61. When the particle is in its lowest energy state, the average momentum ($<p_x>$) of the particle is :

(1) $<p_x> = 0$

(2) $<p_x> = \dfrac{h}{a}$

(3) $<p_x> = \dfrac{h}{2a}$

(4) $<p_x> = \dfrac{h}{2\pi a}$

62. Which of the following statement is *not* true for haemoglobin ?

(1) The binding with oxygen is weaker in comparison with myoglobin

(2) Iron is 5-coordinated

(3) Iron is coplanar with prorphyrin ring in the absence of oxygen

(4) The oxidation state of iron is +2

63. How many minutes are required to deliver 3.21×10^6 coulombs using a current of 500 amperes used in the production of chlorine ?

(1) 8.3   (2) 10×10^3 (3) 6420   (4) 107

64. A solution containing H^+ and D^+ ions is in equilibrium with a mixture of H_2 and D_2 gases at 25°C. If the partial pressure of both gases are 1.0 atm, find the ratio of $[D^+]/[H^+]$:

(Given : $E^°_{D^+/D_2} = -0.003$ V)

(1) 1.23   (2) 1.12   (3) 0.11   (4) 1.0

65. What will be the emf for a given cell ?

$$Pt \,|\, H_2\left(g, P_1\right) |\, H^+(aq) \,\|\, H_2\left(g, P_2\right) |\, Pt$$
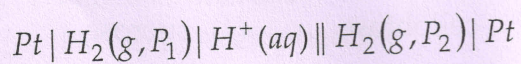
(1) $\dfrac{RT}{F} \ln \dfrac{P_1}{P_2}$

(2) $\dfrac{RT}{F} \ln \dfrac{P_2}{P_1}$

(3) $\dfrac{RT}{2F} \ln \dfrac{P_1}{P_2}$

(4) None of these

66. How much ethyl alcohol must be added to 1.0 L of water so that solution will not freeze at $-4°F$ ($K_f = 1.86°C/m$)

(1) < 20 g   (2) < 10.75 g   (3) < 494.5 g   (4) > 494.5 g

67. When mercuric iodide is added to the aqueous solution of KI, then :

(1) freezing point is raised

(2) freezing point is lowered

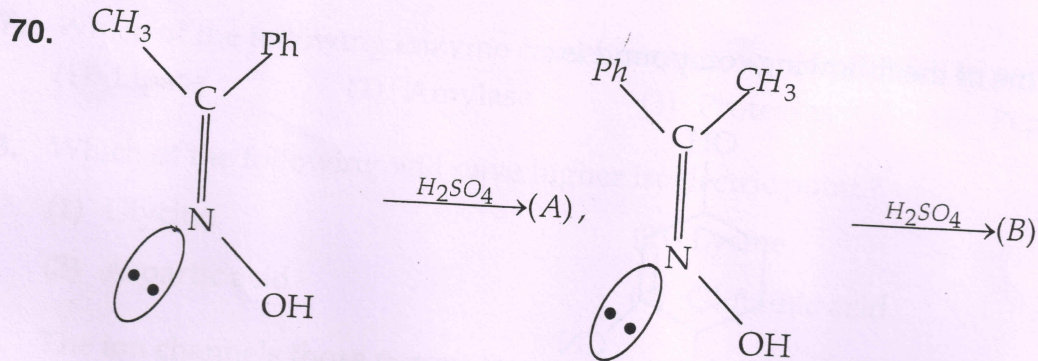(3) freezing point does not change

(4) boiling point does not change

68. In the spinel structure, oxides ions are ccp whereas 1/8th of tetrahedral voids are occupied by A^{2+} and 1/2 of octahedral voids are occupied by B^{3+}. The general formula of the compound is :

(1) $A_2B_2O_4$ (2) AB_2O_4 (3) $A_2B_4O_2$ (4) $A_4B_2O_2$

69. On adding $AgNO_3$ solution into KI solution, a negatively charged colloidal sol is obtained when they are in :

(1) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.01 M KI

(2) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.1 M KI

(3) 50 mL of 0.2 M $AgNO_3$ + 50 mL of 0.1 M KI
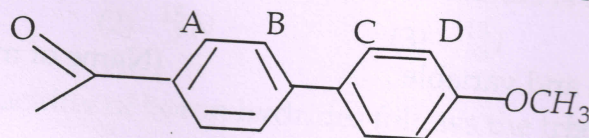
(4) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.2 M KI

C

70.

$$CH_3 \quad Ph$$
$$C$$
$$\parallel$$
$$N$$
$$OH$$
$$\xrightarrow{H_2SO_4} (A),$$

$$Ph \quad CH_3$$
$$C$$
$$\parallel$$
$$N$$
$$OH$$
$$\xrightarrow{H_2SO_4} (B)$$

Product (A) and (B) respectively are :

(1) $Ph-\overset{O}{\underset{\parallel}{C}}-NHCH_3$, $Ph-\overset{O}{\underset{\parallel}{C}}-NHCH_3$ (2) $CH_3-\overset{O}{\underset{\parallel}{C}}-NHPh$, $CH_3-\overset{O}{\underset{\parallel}{C}}-NHPh$

(3) $Ph-\overset{O}{\underset{\parallel}{C}}-NHCH_3$, $CH_3-\overset{O}{\underset{\parallel}{C}}-NHPh$ (4) $CH_3-\overset{O}{\underset{\parallel}{C}}-NHPh$, $Ph-\overset{O}{\underset{\parallel}{C}}-NHCH_3$

71. On which position the attack of nitronium ion would be most rapid, when the compound undergoes nitration with HNO_3 / H_2SO_4
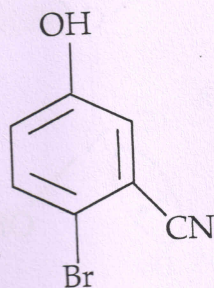

(1) A   (2) B   (3) C   (4) D

72. Which of the following pair gives same phenyl osazone ?

(1) D-glucose and D-allose

(2) D-glucose and D-alfrose

(3) D-glucose and D-mannose

(4) D-glucose and D-talose

73. Stereoisomers of aldoheptose is (a) and stereoisomers of ketoheptose is (b). Ratio of a/b is :

(1) $\dfrac{1}{2}$ (2) $\dfrac{2}{1}$ (3) $\dfrac{4}{1}$ (4) $\dfrac{1}{4}$

74. The IUPAC name of the following compound is :

(1) 4-Bromo-3-Cyano phenol

(2) 2-Bromo-5-hydroxybenzonitrile

(3) 2-Cyano-4-hydroxy bromobenzene

(4) 6-Bromo-3-hydroxybenzonitrile

75. Which is correct matching of **List-I** and **List-II** ?

List-I	List-II
(Quantity measured and variable controlled	(Name of method)

(i) $1/R$ Vs. Volume of titrant   (A) Amperometeric titrations

(ii) i Vs. Volume of titrant, ε (B) Potentiometric titrations

(iii) E Vs. Volume of titrant, $i = 0$ (C) Conductometric titrations

(1) (i) – B, (ii) – C, (iii) – A   (2) (i) – A, (ii) – B, (iii) – C

(3) (i) – C, (ii) – A, (iii) – B   (4) (i) – C, (ii) – B, (iii) – A

76. Cyctochrom is :

(1) oxygen storage protein   (2) redox protein

(3) Cu – containing protein   (4) Mo containing protein

77. Which of the following enzyme causes breakdown of proteins to peptides ?

   (1) Lipase   (2) Amylase   (3) Proteases   (4) Peptidases

78. Which of the following will have higher isoelectric point ?

   (1) Glycine

   (2) Lysine

   (3) Aspartic acid

   (4) Glutamic acid

79. The ion channels those permit transport of Na^+ and K^+ ions, are constructed from :

   (1) globular proteins

   (2) helical protiens

   (3) pleated proteins

   (4) None of these

80. Sulphur is not a constituent of :

   (1) Cysteine   (2) Methionine   (3) Ferredoxin   (4) Pyridoxine

81. If k_{sp} is the solubility product of a Sparingly soluble salt A_3X_2, then its solubility is :

   (1) $(k_{sp}/108)^{1/5}$ (2) $(k_{sp}/72)^{1/5}$ (3) $(k_{sp})^{1/5}$ (4) $(k_{sp})^{1/2}$

82. The radioactive isotope used to locate brain tumors is :

   (1) $_1^2 D$ (2) $_7^{15} N$ (3) $_{53}^{113} I$ (4) $_6^{13} C$

83. The Bronsted acidity of boron hydrides follows the trend :

   (1) $B_2H_6 > B_4H_{10} > B_5H_9 > B_{10}H_{14}$ (2) $B_5H_9 > B_4H_{10} > B_2H_6 > B_{10}H_{14}$

   (3) $B_2H_6 = B_4H_{10} > B_5H_9 = B_{10}H_{14}$ (4) $B_{10}H_{14} > B_5H_9 > B_4H_{10} > B_2H_6$

84. The free energy change (ΔG) of 1 mole of ideal gas which is compressed isothermally from 1 atm to 2 atm is :

   (1) $-RT \ln 2$ (2) RT   (3) $RT \ln 2$ (4) $-RT$

85. Among the following, the system that would require least amount of thermal energy to bring its temperature to 80°C is :

   (1) 200 g of water at 40°C

   (2) 300 g of water at 30°C

   (3) 100 g of water at 20°C

   (4) 150 g of water at 50°C

C

86. The point group symmetry of p-dichlorobenzene is :

    (1) C_{2v} (2) D_{2h} (3) D_3 (4) C_{2h}

87. A certain buffer solution contains equal concentrations of A^- and HA. The kb for A^- is 10^{-10}. The pH of solution is :

    (1) 7   (2) 10   (3) 4   (4) 14

88. The spontaneity of a reaction can be judged from the sign of emf (E) and free energy change (G) of the cell :

    (1) $\Delta G = +ve, E = -ve$ (2) $\Delta G = 0, E = 0$

    (3) $\Delta G = -ve, E = +ve$ (4) $\Delta G = -ve, E = -ve$

89. An aqueous solution is prepared by mixing equal volume of 0.1 M KCl and 0.1 M KI. To this solution a drop of 0.01 M $AgNO_3$ solution is added. Which of the following is correct ?

    (1) A precipitate forms which is primarily AgI

    (2) A precipitate forms which is primarily $AgCl$

    (3) A precipitate forms which is primarily AgI and $AgCl$

    (4) There will be no precipitation as there is no common ions between potassium and silver salts

90. An example of a colligative property is :

    (1) Vapour pressure   (2) Freezing point

    (3) Osmotic pressure   (4) All

91. The decreasing order of the reactivity towards electrophiles :

    (i)   (ii)   (iii)

    (1) (iii) > (ii) > (i)   (2) (i) > (ii) > (iii)   (3) (iii) > (i) > (ii)   (4) (ii) > (i) > (iii)

92. Pyridine undergoes nitration at elevated temperature to give :

(1)

(2)

(3)

(4)
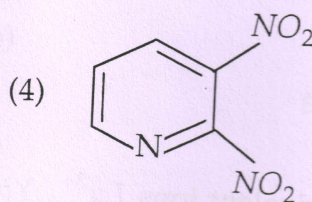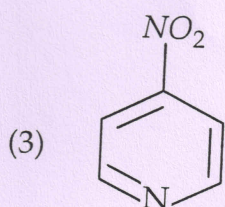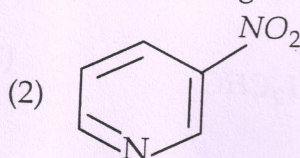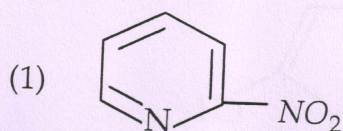
93. Which of the following will not undergo HVZ reaction ?

(1) Acetic acid

(2) Propanoic acid

(3) 2-methyl propanoic acid

(4) 2,2-diemthyl propanoic acid

94. In the Lassaignes's test, the blood red colouration is due to the formation of :

(1) $Fe(CN)_2$

(2) $NaCNS$

(3) $Fe(CNS)_3$

(4) NH_4CNS

95. Conversion of $C_6H_5CN \rightarrow C_6H_5COCH_3$ can be achieved most easily with :

(1) CH_3MgBr followed by hydrolysis

(2) $I_2 / NaOH; CH_3I$

(3) $LiAlH_4$ followed by the reaction CH_3I

(4) dil $H_2SO_4 + CH_2N_2$

96. Cyclohexyl benzyl ether when reacted with hydrogen in the presence of 10% palladium on charcoal generates a mixture of :
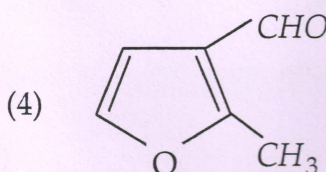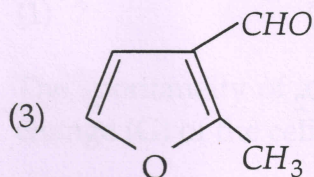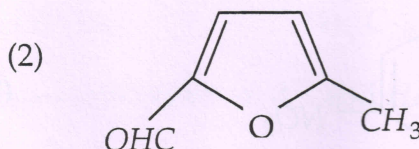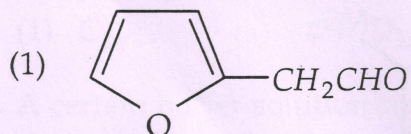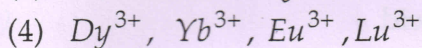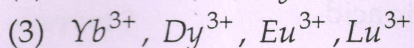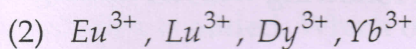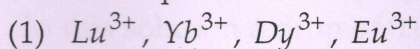
(1) cyclohexanol and benzyl alcohol

(2) cyclohexane and toluene

(3) cyclohexanol and toluene

(4) cyclohexane and bnenzyl alcohol

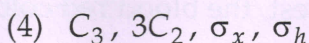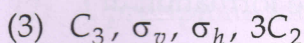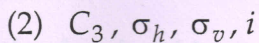**97.** The reaction of 2-methyl furan with DMF-$POCl_3$ would given :

(1) [structure: furan ring with $-CH_2CHO$]

(2) [structure: furan ring with OHC and CH_3]

(3) [structure: furan ring with CHO and CH_3]

(4) [structure: furan ring with CHO and CH_3]

98. The separation of trivalent ions Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+} can be effectively done by a cation exchange resin using ammonium o-hydroxy iso-butyrate as a element. The order of separation of ions would be :

(1) Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+}

(2) Eu^{3+}, Lu^{3+}, Dy^{3+}, Yb^{3+}

(3) Yb^{3+}, Dy^{3+}, Eu^{3+}, Lu^{3+}

(4) Dy^{3+}, Yb^{3+}, Eu^{3+}, Lu^{3+}

99. The symmetry elements present in BF_3 are :

(1) C_3, $3C_2$, S_2, σ_v

(2) C_3, σ_h, σ_v, i

(3) C_3, σ_v, σ_h, $3C_2$

(4) C_3, $3C_2$, σ_x, σ_h

100. The compressibility factor of Vander Waals gas at critical state is :

(1) 1/3   (2) 3/8   (3) 8/27   (4) 3

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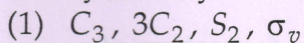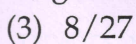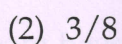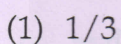
(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

M.Phil./Ph.D./URS-EE-Oct.-2017
SUBJECT : Chemistry

D

10056

Sr. No. ....

Time : **1¼ Hours**   Max. Marks : **100**   Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____   Father's Name_____

Mother's Name_____   Date of Examination_____

_____   _____
(Signature of the Candidate)   (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. *All questions are compulsory.*

2. The candidates **must return** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.

3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.

4. The candidate **must not** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers **must not** be ticked in the question booklet.

5. *There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.*

6. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.

7. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

M.Phil./Ph.D./URS-EE-Oct.-2017/(Chemistry)/(D)

1. When the particle is in its lowest energy state, the average momentum ($<p_x>$) of the particle is :

   (1) $<p_x> = 0$

   (2) $<p_x> = \dfrac{h}{a}$

   (3) $<p_x> = \dfrac{h}{2a}$

   (4) $<p_x> = \dfrac{h}{2\pi a}$

2. Which of the following statement is **not** true for haemoglobin ?
   (1) The binding with oxygen is weaker in comparison with myoglobin
   (2) Iron is 5-coordinated
   (3) Iron is coplanar with prorphyrin ring in the absence of oxygen
   (4) The oxidation state of iron is +2

3. How many minutes are required to deliver 3.21×10^6 coulombs using a current of 500 amperes used in the production of chlorine ?

   (1) 8.3   (2) 10×10^3 (3) 6420   (4) 107

4. A solution containing H^+ and D^+ ions is in equilibrium with a mixture of H_2 and D_2 gases at 25°C. If the partial pressure of both gases are 1.0 atm, find the ratio of $[D^+]/[H^+]$:   (Given : $E^{\circ}_{D^+/D_2} = -0.003$ V)
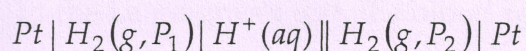
   (1) 1.23   (2) 1.12   (3) 0.11   (4) 1.0

5. What will be the emf for a given cell ?
   $Pt \,|\, H_2(g, P_1) \,|\, H^+(aq) \,\|\, H_2(g, P_2) \,|\, Pt$

   (1) $\dfrac{RT}{F} \ln \dfrac{P_1}{P_2}$

   (2) $\dfrac{RT}{F} \ln \dfrac{P_2}{P_1}$

   (3) $\dfrac{RT}{2F} \ln \dfrac{P_1}{P_2}$

   (4) None of these

6. How much ethyl alcohol must be added to 1.0 L of water so that solution will not freeze at −4°F ($K_f = 1.86$°C/m)

   (1) < 20 g   (2) < 10.75 g   (3) < 494.5 g   (4) > 494.5 g

7. When mercuric iodide is added to the aqueous solution of KI, then :

   (1) freezing point is raised

   (2) freezing point is lowered

   (3) freezing point does not change

   (4) boiling point does not change

8. In the spinel structure, oxides ions are ccp whereas 1/8th of tetrahedral voids are occupied by A^{2+} and 1/2 of octahedral voids are occupied by B^{3+}. The general formula of the compound is :

   (1) $A_2B_2O_4$
   (2) AB_2O_4
   (3) $A_2B_4O_2$
   (4) $A_4B_2O_2$

9. On adding $AgNO_3$ solution into KI solution, a negatively charged colloidal sol is obtained when they are in :
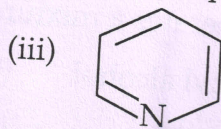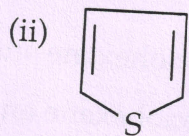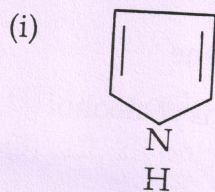
   (1) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.01 M KI

   (2) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.1 M KI

   (3) 50 mL of 0.2 M $AgNO_3$ + 50 mL of 0.1 M KI

   (4) 50 mL of 0.1 M $AgNO_3$ + 50 mL of 0.2 M KI

10.

$$\xrightarrow{H_2SO_4} (A), \qquad \xrightarrow{H_2SO_4} (B)$$
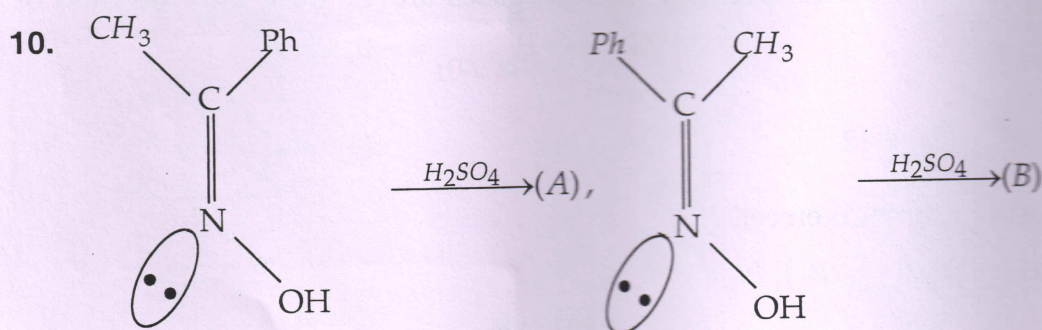
Product (A) and (B) respectively are :

   (1) $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$, $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$
   (2) $CH_3-\overset{O}{\overset{||}{C}}-NHPh$, $CH_3-\overset{O}{\overset{||}{C}}-NHPh$

   (3) $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$, $CH_3-\overset{O}{\overset{||}{C}}-NHPh$
   (4) $CH_3-\overset{O}{\overset{||}{C}}-NHPh$, $Ph-\overset{O}{\overset{||}{C}}-NHCH_3$

11. The decreasing order of the reactivity towards electrophiles :

(i)

N
H

(ii)

S

(iii)

N

(1) (iii) > (ii) > (i)   (2) (i) > (ii) > (iii)   (3) (iii) > (i) > (ii)   (4) (ii) > (i) > (iii)

12. Pyridine undergoes nitration at elevated temperature to give :

(1)

N NO_2

(2)

NO_2
N

(3)
NO_2

N

(4)

NO_2
N
NO_2
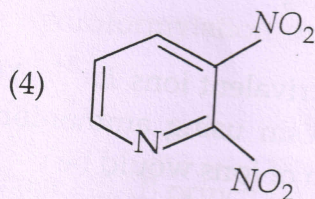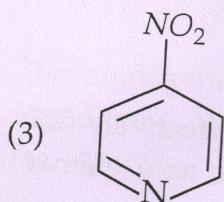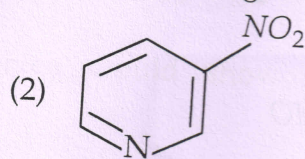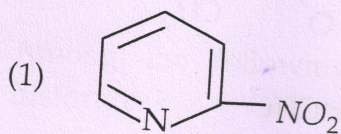
13. Which of the following will not undergo HVZ reaction ?

(1) Acetic acid

(2) Propanoic acid

(3) 2-methyl propanoic acid

(4) 2,2-diemthyl propanoic acid

14. In the Lassaignes's test, the blood red colouration is due to the formation of :

(1) $Fe(CN)_2$ (2) $NaCNS$ (3) $Fe(CNS)_3$ (4) NH_4CNS

15. Conversion of $C_6H_5CN \rightarrow C_6H_5COCH_3$ can be achieved most easily with :

(1) CH_3MgBr followed by hydrolysis

(2) $I_2 / NaOH; CH_3I$

(3) $LiAlH_4$ followed by the reaction CH_3I

(4) dil $H_2SO_4 + CH_2N_2$

16. Cyclohexyl benzyl ether when reacted with hydrogen in the presence of 10% palladium on charcoal generates a mixture of :

    (1) cyclohexanol and benzyl alcohol

    (2) cyclohexane and toluene

    (3) cyclohexanol and toluene

    (4) cyclohexane and bnenzyl alcohol

17. The reaction of 2-methyl furan with DMF-$POCl_3$ would given :

    (1) CH_2CHO structure

    (2)

    (3)

    (4)
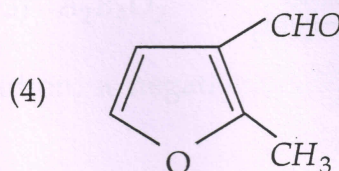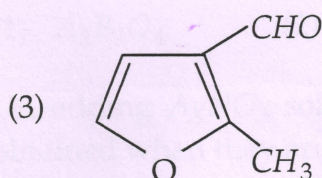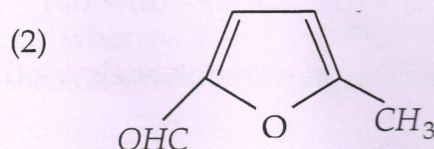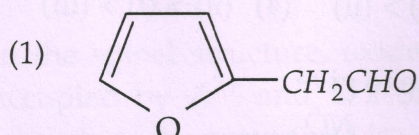
18. The separation of trivalent ions Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+} can be effectively done by a cation exchange resin using ammonium o-hydroxy iso-butyrate as a element. The order of separation of ions would be :

    (1) Lu^{3+}, Yb^{3+}, Dy^{3+}, Eu^{3+}

    (2) Eu^{3+}, Lu^{3+}, Dy^{3+}, Yb^{3+}

    (3) Yb^{3+}, Dy^{3+}, Eu^{3+}, Lu^{3+}

    (4) Dy^{3+}, Yb^{3+}, Eu^{3+}, Lu^{3+}

19. The symmetry elements present in BF_3 are :

    (1) C_3, $3C_2$, S_2, σ_v

    (2) C_3, σ_h, σ_v, i

    (3) C_3, σ_v, σ_h, $3C_2$

    (4) C_3, $3C_2$, σ_x, σ_h

20. The compressibility factor of Vander Waals gas at critical state is :

    (1) 1/3   (2) 3/8   (3) 8/27   (4) 3

21. When benzene sulphonic acid and p-nitrophenol are treated with $NaHCO_3$ the gases released, respectively are :
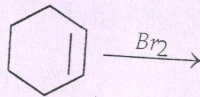
    (1) SO_2, NO_2 (2) SO_2, NO (3) CO_2, CO_2 (4) SO_2, CO_2

22. Which of the following pairs give positive Tollen's test ?

    (1) Glucose, Sucrose

    (2) Glucose, Fructose

    (3) Hexanal, Acetophenone

    (4) Fructose, Sucrose

23. What configuration are found in the product(s) of the reaction ?

$$\text{(structure)} \xrightarrow{Br_2}$$

(1) 1s, 2s only

(2) 1R, 2s only

(3) 1R, 2R only

(4) equal mixture of 1R, 2R and 1s, 2s

24. The compound which shows L ← M charge transfer is :

(1) HgO

(2) $K_2Cr_2O_7$

(3) $Ni(CO)_4$

(4) $[Ni(H_2O)_6]^{2+}$

25. Among the following complexes, which would show the strong Jahn-Teller distortion ?

(1) $[Cr(H_2O)_6]^{2+}$

(2) $[Ti(H_2O)_6]^{3+}$

(3) $[Co(H_2O)_6]^{2+}$

(4) $[Fe(H_2O)_6]^{2+}$

26. The homogeneous catalyst used in the hydroformylation or hydrocarbonylation is based on :

(1) Co

(2) Cr

(3) Ti

(4) V

27. The correct order of the soft character (as per HSAB principle) of the central metal ion is :

(1) $[CrCl_4]^- < [Cr(bipy)_3] < [CrO_4]^{2-} < [Cr(CO)_5]^{2-}$

(2) $[CrCl_4]^- < [CrO_4]^{2-} < [Cr(CO)_5]^{2-} < [Cr(bipy)_3]$

(3) $[CrO_4]^{2-} < [CrCl_4]^{2-} < [Cr(bipy)_2] < [Cr(CO)_5]^{2-}$

(4) $[CrO_4]^{2-} < [Cr(CO)_5]^{2-} < [CrCl_4]^{2-} < [Cr(bipy)_3]$

28. Lewis acidity of BMe_3, BPh_3 and BCl_3 wrt pyridine follows the order :

(1) $BCl_3 > BPh_3 > BMe_3$

(2) $BMe_3 > BPh_3 > BCl_3$

(3) $BPh_3 > BCl_3 > BMe_3$
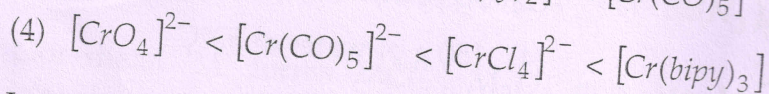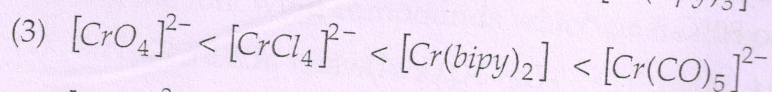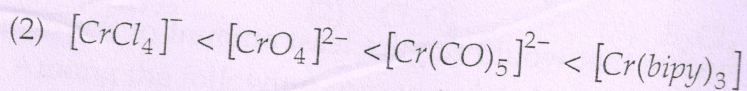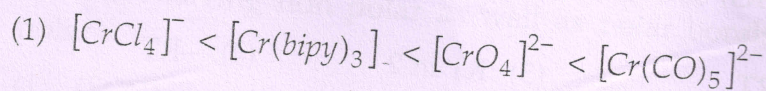
(4) $BCl_3 > BMe_3 > BPh_3$
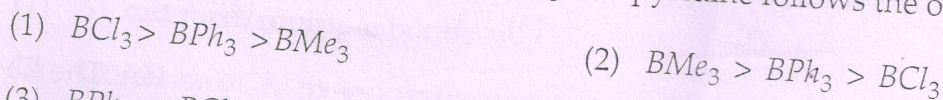
29. A disaccharide that will not give Benedict's test and will not form osazone is :

(1) maltose

(2) lactose

(3) cellobiose

(4) sucrose

D

30. Polarographic method of analysis to obtain individual amounts of Cu^{2+} and Cd^{++} in a given mixture of the two ions (Cu^{2+} and CCl^{2+}) is achieved by measuring their :

(1) half wave potentials

(2) migration current

(3) decomposition potentials

(4) diffusion current

31. If k_{sp} is the solubility product of a Sparingly soluble salt A_3X_2, then its solubility is :

(1) $(k_{sp}/108)^{1/5}$ 　　(2) $(k_{sp}/72)^{1/5}$ 　　(3) $(k_{sp})^{1/5}$ 　　(4) $(k_{sp})^{1/2}$

32. The radioactive isotope used to locate brain tumors is :

(1) ^2_1D 　　　　(2) $^{15}_7N$ 　　　　(3) $^{113}_{53}I$ 　　　　(4) $^{13}_6C$

33. The Bronsted acidity of boron hydrides follows the trend :

(1) $B_2H_6 > B_4H_{10} > B_5H_9 > B_{10}H_{14}$

(2) $B_5H_9 > B_4H_{10} > B_2H_6 > B_{10}H_{14}$

(3) $B_2H_6 = B_4H_{10} > B_5H_9 = B_{10}H_{14}$

(4) $B_{10}H_{14} > B_5H_9 > B_4H_{10} > B_2H_6$

34. The free energy change (ΔG) of 1 mole of ideal gas which is compressed isothermally from 1 atm to 2 atm is :

(1) $-RT\ln 2$ 　　(2) RT 　　　(3) $RT\ln 2$ 　　　(4) $-RT$

35. Among the following, the system that would require least amount of thermal energy to bring its temperature to 80°C is :

(1) 200 g of water at 40°C

(2) 300 g of water at 30°C

(3) 100 g of water at 20°C

(4) 150 g of water at 50°C

36. The point group symmetry of p-dichlorobenzene is :

(1) C_{2v} 　　(2) D_{2h} 　　　(3) D_3 　　　(4) C_{2h}

37. A certain buffer solution contains equal concentrations of A^- and HA. The kb for A^- is 10^{-10}. The pH of solution is :

(1) 7 　　　(2) 10 　　　(3) 4 　　　(4) 14

38. The spontaneity of a reaction can be judged from the sign of emf (E) and free energy change (G) of the cell :

(1) ΔG = +ve, E = – ve

(3) ΔG = –ve, E = + ve

(2) ΔG = 0, E = 0

(4) ΔG = –ve, ε E – ve

39. An aqueous solution is prepared by mixing equal volume of 0.1 M KCl and 0.1 M KI. To this solution a drop of 0.01 M $AgNO_3$ solution is added. Which of the following is correct ?

(1) A precipitate forms which is primarily AgI

(2) A precipitate forms which is primarily AgCl

(3) A precipitate forms which is primarily AgI and AgCl

(4) There will be no precipitation as there is no common ions between potassium and silver salts

40. An example of a colligative property is :

(1) Vapour pressure

(3) Osmotic pressure

(2) Freezing point

(4) All

41. Molecule having non polar as well as polar bonds but the molecule as a whole is polar :

(1) $(SCN)_2$

(2) Cl_2O_8

(3) B_2Cl_4

(4) I_2Cl_6

42. Among the following compounds which on heating do not produce N_2 ?
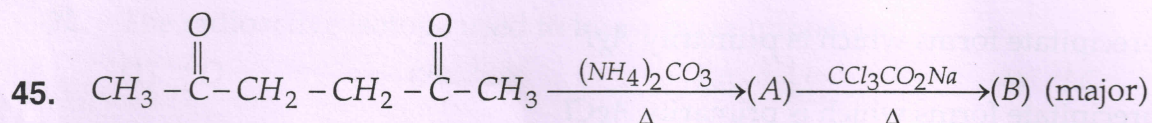
(1) $NH_4Cl + CaO$

(2) $(NH_4)_2Cr_2O_7$

(3) $Ba(N_3)_2$

(4) $NH_4Cl + NaNO_2$

43. Non-metal 'M' forms MCl_3, M_2O_5 and Mg_3M_2 but does not form MI_5. The incorrect statement regarding non-metal is :

(1) 'M' can form multiple bonds

(2) Atomicity of 'M' is 4

(3) 'M' is second period element

(4) The range of oxidation number for M is +5 to –3

44. Which of the following order is correct ?

(1) $K^+ < Ca^{++} < P^{3-} < S^{2-}$: ionic size

(2) $Na^+(aq) > K^+(aq) > Rb^+(aq) > Cs^+(aq)$: electrical conductance

(3) $Al^{3+}(aq) > Mg^{2+}(aq) > Na^+(aq)$: hydrate size

(4) $I^-(aq) < Br^-(aq) < Cl^-(aq) < F^-(aq)$: ionic mobility

45.

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow[\Delta]{(NH_4)_2CO_3} (A) \xrightarrow[\Delta]{CCl_3CO_2Na} (B) \text{ (major)}$$

Product (B) of above reaction is :

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

46.

$$\underset{H}{\overset{R}{>}}C=N\diagup^X$$

where X = CH_3COO^-, $Cl-CH_2COO^-$, $PhSO_3^-$
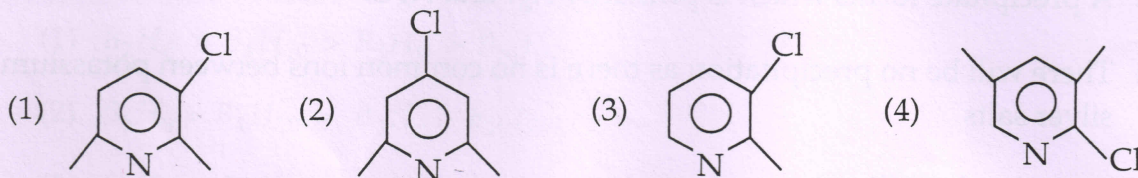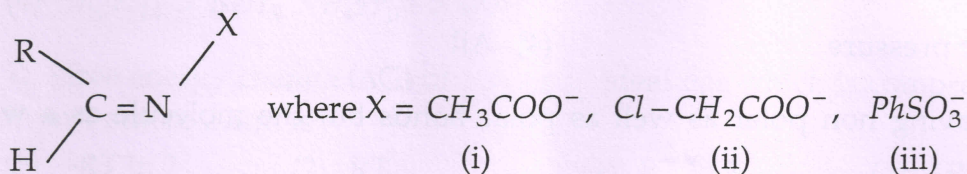
(i)   (ii)   (iii)

Rate of reaction toward Beckmann rearrangement :

(1) (i) > (ii) > (iii)   (2) (ii) > (i) > (iii)

(3) (iii) > (ii) > (i)   (4) (iii) > (i) > (ii)

47. Which of the following reaction, does not give chlorobenzen as a product ?

(1) $\xrightarrow{CHCl_3, OH^\ominus}$ (2) $\xrightarrow{CHBrCl_2, OH^\ominus}$

(3) $\xrightarrow{CHBr_2Cl, OH^\ominus}$ (4) $\xrightarrow{CHFClBr, OH^\ominus}$

48. $Ph - \overset{\overset{O}{\|}}{\underset{14}{C}} - CHN_2 \xrightarrow[H_2O]{Ag_2O} A$, Product 'A' is :

(1) $Ph^{14}CH_2COOH$

(2) $PhCH_2{}^{14}COOH$

(3) $Ph^{14}COOH$

(4) $PhCOOH$

49.

$\xrightarrow[\text{(ii) } SOCl_2]{\text{(i) } HCl}(A) \xrightarrow[C_6H_6]{AlCl_3}(B) \xrightarrow{KOH/MeOH}(C)$

Compound 'C' is :

(1) $Ph - CH_2 - \overset{\overset{O}{\|}}{C} \triangleleft$

(2) $PhCH = CH - \overset{\overset{O}{\|}}{C} - CH_3$

(3) $Ph - \overset{\overset{O}{\|}}{C} \triangleleft$

(4) $Ph - \overset{\overset{O}{\|}}{C} - CH = CH - CH_3$
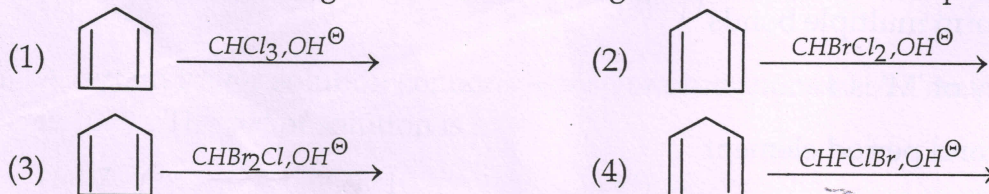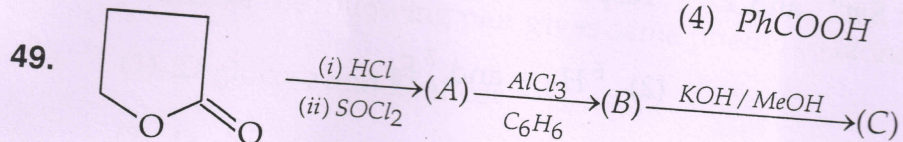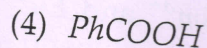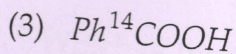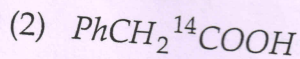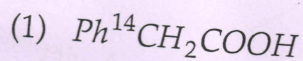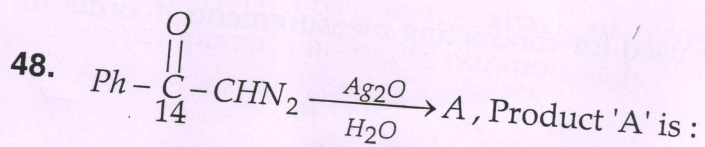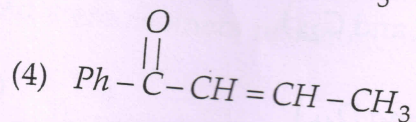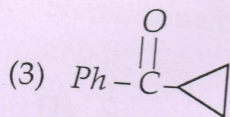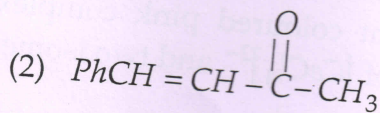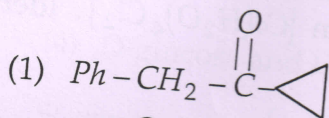
50. Which of the following benzene ring substituents is deactivating but ortho-para directing ?

(1) $-N=O$

(2) $-OCH_3$

(3) $-COCH_3$

(4) $-NO_2$
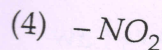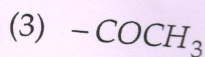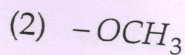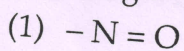
51. The strong field in $[Fe(CN)_6]^{3-}$ will split the 3d orbitals. Their separation may be observed in the spectroscopy of :

(1) NMR

(2) ESR

(3) IR

(4) Electronic absorption

52. Movement of nuclei is negligible during time taken by an electronic transition is called :

(1) Franck Condon Principle

(2) Lambert Beer Law

(3) Born-Oppenheimer approximation

(4) None

53. The number of ESR peak(s) expected for ^{14}N is (are) :

(1) 1

(2) 2

(3) 3

(4) 4

54. The platinised platinum electrodes are used for conducting measurements in order to remme which of the following effect ?

    (1) Precipation effect   (2) Solubility effect

    (3) Polarisation effect   (4) Redox effect

55. The ground state term of Sm^{3+} and Eu^{2+} respectively are :

    (1) $^7F_0$ and $^6H_{5/2}$ (2) $^6H_{5/2}$ and $^7F_0$

    (3) $^2F_{5/2}$ and $^5I_4$ (4) $^7F_6$ and $^2H_{7/2}$

56. $[CoCl_4]^{2-}$ is a blue coloured complex controlled treatment of this complex with water gives two light coloured pink complexes of composition $[Co(H_2O)_4Cl_2]$. Identify point groups of $[CoCl_4]^{2-}$ and two isomeric complexes :

    (1) $D_{4h}(C_{2v}$ and $C_{2h})$ (2) $D_{4h}(C_{2v}$ and $C_{4h})$

    (3) $T_d(C_{2v}$ and $D_{4h})$ (4) $T_d(C_{2v}$ and $C_{4h})$

57. Kelvin's thermodynamics scale of temperature is based on :

    (1) Charle's Law   (2) Joule's Law

    (3) Amagat's Law   (4) Carnot's principle

58. Calculate the work of expansion when 2 moles of an ideal gas expands isothermally and reversibly from 10 L to 20 L at 300 K :

    (1) 826.5 cal   (2) 413.25 cal   (3) –826.5 cal   (4) –413.25 cal

59. Which of the following is strongest reducing agent ?

    (1) $GeCl_2$ (2) $SnCl_2$ (3) $PbCl_2$ (4) $SnCl_4$

60. The total pressure for the reaction $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ under the equilibrium condition is 15 atms. The value of Kp is :

    (1) 16   (2) 2   (3) 20   (4) 25

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61. On which position the attack of nitronium ion would be most rapid, when the compound undergoes nitration with HNO_3 / H_2SO_4

(1) A
(2) B
(3) C
(4) D
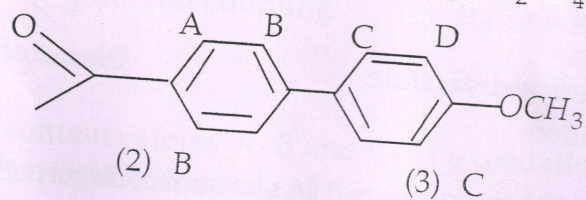
62. Which of the following pair gives same phenyl osazone ?

(1) D-glucose and D-allose

(2) D-glucose and D-alfrose

(3) D-glucose and D-mannose

(4) D-glucose and D-talose

63. Stereoisomers of aldoheptose is (a) and stereoisomers of ketoheptose is (b). Ratio of a/b is :

(1) $\dfrac{1}{2}$
(2) $\dfrac{2}{1}$
(3) $\dfrac{4}{1}$
(4) $\dfrac{1}{4}$

64. The IUPAC name of the following compound is :
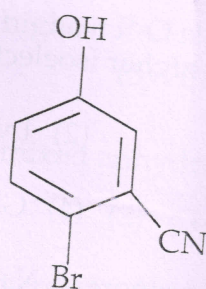
(1) 4-Bromo-3-Cyano phenol

(2) 2-Bromo-5-hydroxybenzonitrile

(3) 2-Cyano-4-hydroxy bromobenzene

(4) 6-Bromo-3-hydroxybenzonitrile

65. Which is correct matching of **List-I** and **List-II** ?

	List-I	List-II
	(Quantity measured and variable controlled	(Name of method)

(i) $1/R$ Vs. Volume of titrant

(A) Amperometeric titrations

(ii)   i Vs. Volume of titrant, ε

(B) Potentiometric titrations

(iii)   E Vs. Volume of titrant, i = 0

(C) Conductometric titrations

(1) (i) – B, (ii) – C, (iii) – A

(2) (i) – A, (ii) – B, (iii) – C

(3) (i) – C, (ii) – A, (iii) – B

(4) (i) – C, (ii) – B, (iii) – A

66. Cyctochrom is :

(1) oxygen storage protein

(2) redox protein

(3) Cu – containing protein

(4) Mo containing protein

67. Which of the following enzyme causes breakdown of proteins to peptides ?

(1) Lipase   (2) Amylase   (3) Proteases   (4) Peptidases

68. Which of the following will have higher isoelectric point ?

(1) Glycine

(2) Lysine

(3) Aspartic acid

(4) Glutamic acid

69. The ion channels those permit transport of Na^+ and K^+ ions, are constructed from :

(1) globular proteins

(2) helical protiens

(3) pleated proteins

(4) None of these

70. Sulphur is not a constituent of :

(1) Cysteine   (2) Methionine   (3) Ferredoxin   (4) Pyridoxine

71. Mg^{2+} is prefered in photosynthesis by chlorophyll because :

    (1) It has strong spin orbit coupling
    (2) It has weak spin orbit coupling
    (3) It is a heavy metal
    (4) It is high reactive metal

72. A compound contains atoms A, B and C. The oxidation number of A is +2, of B is +5 and C is −2. The possible formula of the compound is :

    (1) ABC_2
    (2) $B_2(AC_3)_2$
    (3) $A_3(BC_4)_2$
    (4) $A_3(B_4C)_2$

73. Which among the followings is microwave inactive ?

    (1) NO
    (2) Br_2
    (3) CO
    (4) C_2H_4

74. Which of the following species does not obey Huckel Rule ?

    (1) cyclopentadienyl anion
    (2) cyclopentadienyl cation
    (3) cyclopropane cation
    (4) Tropylium cation

75. Write the increasing order of relative basicity of the amine, imine and nitrile :

    (1) amine > imine > nitrile
    (2) imine > nitrile > amine
    (3) nitrile > amine > imine
    (4) nitrile < imine < amine

76. Which among the following has highest P-O stretching frequency ?

    (1) $(CH_3)_3PO$
    (2) Br_3PO
    (3) Cl_3PO
    (4) F_3PO

77. The oxide of chlorine, which is a mixed anhydride ?

    (1) Cl_2O
    (2) ClO_2
    (3) Cl_2O_3
    (4) Cl_2O_7

78. Which reagent is used for the conversion of benzyl to benilic acid ?

    (1) Conc. HCl
    (2) Conc. KOH
    (3) $TiCl_4$
    (4) $KMnO_4$

79. Which in the correct order of vapour pressure of 0.1 M aqueous solution of $FeCl_3$, $NaCl$, $CaCl_2$ and Glucose ?

    (1) Glucose > $NaCl$ > $CaCl_2$ > $FeCl_3$
    (2) $NaCl$ > $CaCl_2$ > $FeCl_3$ > Glucose
    (3) $NaCl$ > Glucose > $CaCl_2$ > $FeCl_3$
    (4) $FeCl_3$ > $CaCl_2$ > $NaCl$ > Glucose

80. Phenol associates in benzene to form dimer. The Van't Hoff's factor is 0.54. What is the degree of association ?

(1) 0.46   (2) 0.54   (3) 0.88   (4) 0.92

81. R–(–)–2–Bromooctane on reaction with aqueous KOH mainly gives 2-octanol that is :

(1) optically active with 'R' configuration

(2) a racemic mixture

(3) optically active with 'S' configuration

(4) a meso compound

82. The correct order of acidity among :
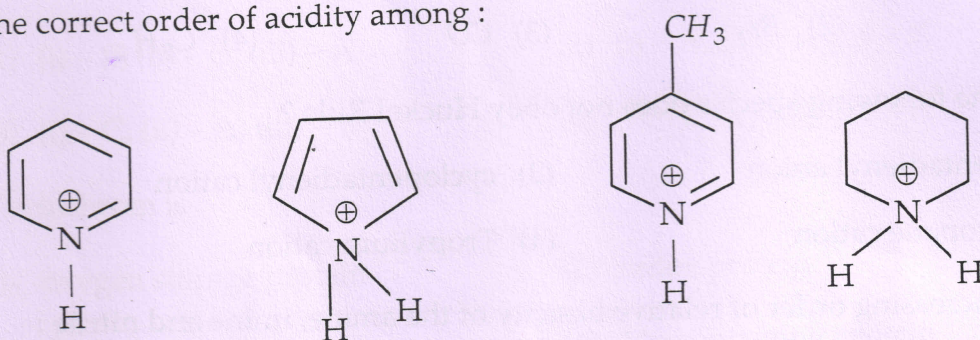
(1) (i) < (ii) < (iii) < (iv)   (2) (iv) < (iii) < (i) < (ii)

(3) (ii) < (i) < (iii) < (iv)   (4) (ii) < (iv) < (i) < (iii)

83. At room temperature, the number of singlet resonance observed in the ^1H spectrum of $Me_3CC(O)NMe_2$ is :

(1) 3   (2) 4   (3) 5   (4) 2

84. The exceptionally low carbonyl stretching frequency (1650 cm^{-1}) in 2, 4, 6-cycloheptatrienone is due to :

(1) conjugation effect   (2) steric effect

(3) field effect   (4) electronic effect

85. Conversion of $PhNH_2$ to $PhCN$ can be done by :

(1) reaction with $NaCN$ in the presence of Ni catalyst

(2) reaction with $CHCl_3$ and $NaOH$

(3) diazotization followed by the reaction with $CuCN$

(4) reaction with ethylformate followed by the reaction with $NaCN$

D

86. The major product formed in the reaction of anisole with Lithium, liquid ammonia and t-butanol is :

(1) 1-methoxycyclohexa-1, 3-diene   (2) 2-methoxycyclohexa-1, 3-diene

(3) 1-methoxycyclohexa-1, 4-diene   (4) 3-methoxycyclohexa-1, 4-diene

87. Which of the following molecules have $n \rightarrow \pi^*$ transition at the lowest wavelength ?

(1) $HCHO$ (2) $CH_3COC_6H_5$ (3) $CH_3COC_2H_5$ (4) $C_6H_5COC_6H_5$

88. Aniline can be distinguished from methyl amine by its reaction with :

(1) p-toluene sulphonyl chloride/KOH

(2) Sn/HCl

(3) Acetyl chloride

(4) (i) $NaNO_2 / HCl\ 0 - 5°C$

     (ii) alkaline β-napthol

89. SN^1 reaction on optically active substrates mainly give :

(1) retention in configuration   (2) inversion in configuration

(3) racemic product   (4) no product

90. Which among the following is solvolysed at the faster rate ?

(1) $C_6H_5CH_2Cl$ (2) $Me_3C - Cl$

(3) $CH_2 = CH - CH_2Cl$ (4) $(C_6H_5)_3C - Cl$

91. The ground states of high spin octahedral and tetrahedral Co(II) complexes are respectively :

(1) $^4T_{2g}$ and $^4A_2$ (2) $^4T_{1g}$ and $^4A_2$ (3) $^3T_{1g}$ and $^4A_2$ (4) $^4T_{1g}$ and $^3T_1$

92. A true statement about base h9ydrolysis of $[Co(NH_3)_5Cl]^{2+}$:

(1) It is first order reaction

(2) The rate determining step involves the dissociation of chloride in $[Co(NH_3)_4(NH_2)Cl]^+$

(3) The rate is independent of the concentration of the base

(4) The rate determining step involves the abstraction of a proton from $[Co(NH_3)_5Cl]^{2+}$

16

93. $B_{10}C_2H_{12}$ is isoelectronic with :

(1) $B_{12}H_{12}^{2-}$ (2) $B_{12}H_{12}$ (3) $B_{12}H_{12}^{2+}$ (4) $B_{12}H_{12}^{4-}$

94. Which of the following is the strongest oxidizing agent ?

(1) In^{3+} (2) Ga^{3+} (3) Ti^{3+} (4) Al^{3+}

95. Electron transfer from $\left[Fe(H_2O)_6\right]^{2+}$ to $\left[Fe(H_2O)_6\right]^{3+}$ is likely to occur via :

(1) d-d transition   (2) inner sphere electron transfer

(3) SN^1 mechanism   (4) outer sphere electron transfer

96. The neutral complex which follows 18-electron rule is :

(1) $\left(\eta^5-C_5H_5\right)Fe(CO)_2$ (2) $\left(\eta^5-C_5H_5\right)Mo(CO)_3$

(3) $\left(\eta^5-C_5H_5\right)Co$ (4) $\left(\eta^5-C_5H_5\right)Re\left(\eta^5-C_6H_6\right)$

97. The degree of hydration is expected to the maximum for :

(1) Mg^{2+} (2) Na^+ (3) Ba^{2+} (4) K^+

98. For this system in equilibrium $CaCO_3(s) \rightleftharpoons CaO(s)+CO_2(g)$ the number of components (C), phases (P) and degree of freedom (F), respectively are :

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

99. The compound having highest melting point :

(1) $LiCl$ (2) LiF (3) $LiBr$ (4) LiI

100. The pH of a $1.0\times10^{-3}\,\mu$ solution of a weak acid HA is 4.0. The dissociation constant k_a is :

(1) 1.0×10^{-3} (2) 1.0×10^{-4} (3) 1.0×10^{-5} (4) 1.0×10^{-6}

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1. 2	16. 2	31. 3	46. 4	61. 4	76. 4	91. 1
2. 2	17. 3	32. 2	47. 2	62. 1	77. 2	92. 1
3. 1	18. 3	33. 4	48. 2	63. 3	78. 3	93. 2
4. 3	19. 1	34. 3	49. 4	64. 3	79. 4	94. 3
5. 4	20. 3	35. 1	50. 4	65. 2	80. 3	95. 1
6. 4	21. 2	36. 1	51. 3	66. 3	81. 4	96. 3
7. 1	22. 2	37. 3	52. 2	67. 1	82. 3	97. 4
8. 4	23. 1	38. 1	53. 4	68. 3	83. 1	98. 2
9. 2	24. 1	39. 4	54. 3	69. 1	84. 2	99. 3
10. 3	25. 3	40. 4	55. 1	70. 3	85. 3	100. 1
11. 1	26. 3	41. 2	56. 2	71. 1	86. 2	
12. 3	27. 4	42. 3	57. 2	72. 3	87. 3	
13. 4	28. 4	43. 4	58. 1	73. 3	88. 2	
14. 3	29. 3	44. 2	59. 3	74. 2	89. 2	
15. 4	30. 4	45. 4	60. 2	75. 3	90. 4	

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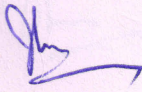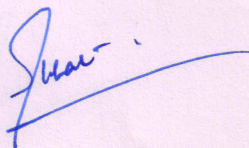
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