Paper Code No- **BM26/2**

Question Booklet No...**626162**

# ENTRANCE EXAMINATION-2018

## M.SC. CHEMISTRY: MATERIALS/IN-ORGANIC/ORGANIC/PHYSICAL)

## SET B

ROLL NO. [redacted]

.....

Signature of Invigilator

**Time: 1 Hour 45 Minutes**

**Total Marks: 100**

### Instructions to Candidates

1. Do not write your name or put any other mark of identification anywhere in the OMR Response Sheet. **IF ANY MARK OF IDENTIFICATIONS IS DISCOVERED ANYWHERE IN OMR RESPONSE SHEET, the OMR sheet will be cancelled, and will not be evaluated.**
2. This Question Booklet contains the cover page and a total of **100 Multiple Choice Questions of 1mark each.**
3. Space for rough work has been provided at the beginning and end. Available space on each page may also be used for rough work.
4. There is negative marking in Multiple Choice Questions. For each wrong answer, 0.25 marks will be deducted.
5. USE OF CALCULATOR IS NOT PERMITTED.
6. USE/POSSESSION OF ELECTRONIC GADGETS LIKE MOBILE PHONE, iPhone, iPad, pager ETC. is strictly **PROHIBITED.**
7. Candidate should check the serial order of questions at the beginning of the test. If any question is found missing in the serial order, it should be immediately brought to the notice of the Invigilator. No pages should be torn out from this question booklet.
8. Answers must be marked in the OMR response sheet which is provided separately. OMR Response sheet must be handed over to the invigilator before you leave the seat.
9. The OMR response sheet should not be folded or wrinkled. The folded or wrinkled OMR/response Sheet will not be evaluated.
10. Write your Roll Number in the appropriate space (above) and on the OMR Response Sheet. Any other details, if asked for, should be written only in the space provided.
11. There are four options to each question marked A, B, C and D. Select one of the most appropriate option and fill up the corresponding oval/circle in the OMR Response Sheet provided to you. The correct procedure for filling up the OMR Response Sheet is mentioned below.
12. **Use Black or Blue Ball Pen** only for filling the ovals/circles in OMR Response Sheet. Darken the selected oval/circle completely. If the correct answer is 'B', the corresponding oval/circle should be completely filled and darkened as shown below.

| CORRECT METHOD |
|---|
| (A) (●) (C) (D) |

| WRONG METHOD | | | | | | | |
|---|---|---|---|---|---|---|---|
| (A) (⊗) (C) (D) | (A) (✓) (C) (D) | (A) (B) (C) (D) | (A) (●) (C) (D) | ( ) (●) (C) (D) | (A) (●) (C) (●) | | |

1. Which one of the following is the correct formula for the lowest-energy eigenfunction for a particle in a one-dimensional box having infinite barriers at x = − L/2 and L/2?

(A) $\sqrt{\frac{2}{L}}\sin\left(\frac{\pi x}{L}\right)$ (B) $\sqrt{\frac{2}{L}}\cos\left(\frac{\pi x}{L}\right)$

(C) $\sqrt{\frac{2}{L}}\exp\left(\frac{i\pi x}{L}\right)$ (D) $\sqrt{\frac{2}{L}}\exp\left(\frac{-i\pi x}{L}\right)$

2. For a single particle-in-a-ring system having energy $9h^2/8\pi^2 I$ we can say that the angular momentum, when measured, will equal:

(A) $3h/2\pi$ (B) $\sqrt{12}h/2\pi$

(C) either $3h/2\pi$ or $-3h/2\pi$ (D) zero

3. A molecule in a gas undergoes about $1.0 \times 10^9$ collisions in each second. Suppose that one collision in 10 is effective in deactivating the molecule rotationally. The width (in hertz) of rotational transitions in the molecule will be:

(A) 1.59 MHz (B) 15.9 MHz

(C) 159 MHz (D) None of the above

4. The rotational structure in the Raman spectrum of carbon dioxide ($CO_2$), is offset from the wavenumber of the incident radiation by 2.3622 $cm^{-1}$, 5.5118 $cm^{-1}$, 8.6614 $cm^{-1}$, ..... The rotational constant of carbon dioxide is:

(A) 0.3937 $cm^{-1}$ (B) 0.5906 $cm^{-1}$

(C) 1.1811 $cm^{-1}$ (D) 2.3622 $cm^{-1}$

5. In a given cell, solution I transmits 42.0 per cent and solution II 85.0 per cent of radiation having a certain wavelength. What is the transmittance at the same wavelength of a solution made by mixing 35.0 $cm^3$ of solution I and 55.0 $cm^3$ of solution II, if no reaction occurs?

(A) 64.6 % (B) 68.3 %

(C) 35.7 % (D) 44.7 %

6. $\Delta H_{vap} = 30$ kJ $mol^{-1}$ and $\Delta S_{vap} = 75$ kJ $mol^{-1}K^{-1}$. Find temperature of vapour, at one atmosphere:

(A) 250 K (B) 298 K

(C) 350 K (D) 400 K

7. 0.1 mole of $CH_3NH_2$ ($K_b = 5 \times 10^{-4}$ M) is mixed with 0.08 mole of HCl and diluted to one litre. What will be the $H^+$ concentration in the solution?

(A) $8 \times 10^{-2}$ M (B) $8 \times 10^{-11}$ M

(C) $1.6 \times 10^{-11}$ M (D) $8 \times 10^{-5}$ M

8. The pH of a salt of weak acid with weak base is given by the expression if $K_w$, $K_a$ and $K_b$ are the dissociation constants of water, weak acid and weak base respectively:

(A) pH = ½ ($pK_w + pK_a + pK_b$) (B) pH = ½ ($pK_w - pK_a - pK_b$)

(C) pH = ½ ($pK_w + pK_a - pK_b$) (D) pH = ½ ($pK_a + pK_b - pK_w$)

9. Nicotinic acid ($K_a = 1.4 \times 10^{-5}$ M) is represented by HNic. The % dissociation in a solution will be if it contained 0.1 mole of nicotinic acid per litre of solution:

(A) 1.673 (B) 4

(C) 6.673 (D) 10

10. Molar heat capacity of water in equilibrium with ice at constant pressure is
(A) 0
(B) ∞
(C) 40.45 kJ $K^{-1}mol^{-1}$
(D) 75.48 kJ $K^{-1}mol^{-1}$

11. Spontaneous adsorption of a gas on solid surface is an exothermic process because
(A) ΔH increases for system
(B) ΔS increases for gas
(C) ΔS decreases for gas
(D) ΔG increases for gas

12. The solubility of the sparingly soluble salt (LxMy) is 'S'. The solubility product ($K_{SP}$) of this salt is:
(A) $S^{xy}$
(B) $S^{x+y}$
(C) $x^x y^y S^{xy}$
(D) $x^x y^y S^{x+y}$

13. An azeotropic mixture is a:
(A) constant vapour pressure mixture
(B) constant volume mixture
(C) constant temperature mixture
(D) constant boiling mixture

14. Tyndall effect exhibited by colloidal particles is characteristic of:
(A) Kinetic property
(B) Optical property
(C) Magnetic property
(D) Electrical property

15. When equal volumes of following solutions are mixed, precipitation of AgCl ($K_{sp}$ = 1.8 x $10^{-10}$ $M^2$) will occur only with:
(A) $10^{-4}$ M [$Ag^+$], $10^{-4}$ M [$Cl^-$]
(B) $10^{-5}$ M [$Ag^+$], $10^{-5}$ M [$Cl^-$]
(C) $10^{-6}$ M [$Ag^+$], $10^{-6}$ M [$Cl^-$]
(D) $10^{-10}$ M [$Ag^+$], $10^{-10}$ M [$Cl^-$]

16. The enthalpy and entropy change for a chemical reaction are -2.5 x $10^{-3}$ cal and 7.4 cal $deg^{-1}$ respectively. Predict the nature of the reaction at 298K.
(A) Reversible
(B) Irreversible
(C) Spontaneous
(D) Non-spontaneous

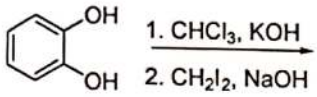
17. Which one of the following solution will have the highest boiling point?
(A) 1% NaCl in water
(B) 1% $CaCl_2$ in water
(C) 1% glucose in water
(D) 1% sucrose in water

18. Which of the following reaction is called as 'Clemmensen reduction?
(A) Reduction of acyl halide with $H_2/Pd/BaSO_4$
(B) Reduction of ester with $Na/C_2H_5OH$
(C) Reduction of anhydride with $LiAlH_4$
(D) Reduction of carbonyl compounds with Na/Hg/HCl

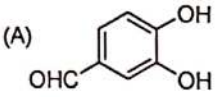
19. An organic compound $C_3H_6O$ does not give a precipitate with 2,4-dinitrophenyl hydrazine reagent and does not react with sodium metal. It could be:

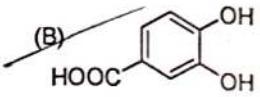
(A) $CH_2=CH-CH_2OH$ (B) $CH_2=CH-OMe$

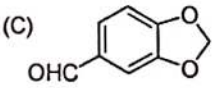
(C) $CH_3CH_2CHO$ (D) $CH_3COCH_3$

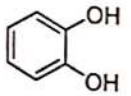
20. 

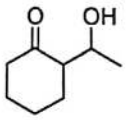
P, Here 'P' is

(A) 

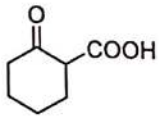
(B) 

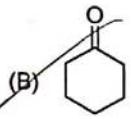
(C) 

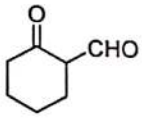
(D) 

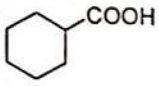
21. 

P, Here 'P' is

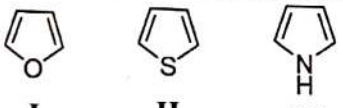
(A) 

(B) 

(C) 

(D) 

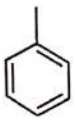
22. Correct order of aromatic character for the given compounds is:

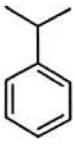


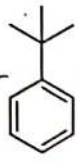
I II III

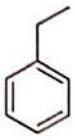
(A) I > II > III (B) II > I > III (C) III > I > II (D) II > III > I

23. Which of the following will undergo nitration faster?

(A) 

(B) 

(C) 

(D) 

24. For the electrophilic substitution reaction involving sulfonation, which of the following sequence regarding the rate of reaction is true?

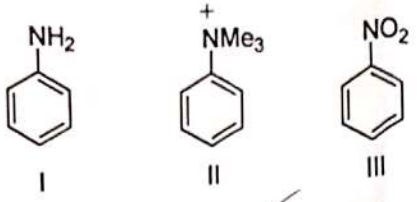
(A) $k(C_6H_6) = k(C_6D_6) = k(C_6T_6)$

(B) $k(C_6H_6) > k(C_6D_6) > k(C_6T_6)$

(C) $k(C_6H_6) < k(C_6D_6) < k(C_6T_6)$

(D) $k(C_6H_6) < k(C_6D_6) > k(C_6T_6)$

25. Which of the following will give Friedel-Crafts reaction?



I II III

(A) Only I (B) I and III (C) all of these (D) none of these

26. The most basic compound among the following is:
(A) Benzylamine (B) Aniline (C) *p*-Nitroaniline (D) Acetanilide

27. Nitrobenzene can be prepared from benzene by using a mixture of conc. $HNO_3$ and conc. $H_2SO_4$. In the nitrating mixture $HNO_3$ acts as.
(A) Acid (B) Base (C) Catalyst (D) Reducing agent

28. The most acidic compound among the following is:

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

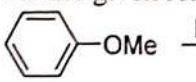
29. The type of isomerism observed in urea molecule is:
(A) Chain (B) Position (C) Geometrical (D) Functional

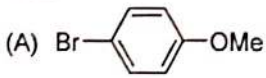
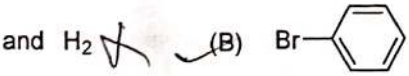
30. Number of possible 3D-isomers of glucose are:
(A) 4 (B) 10 (C) 16 (D) 32

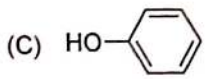
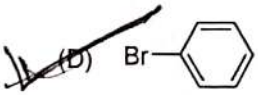
31. Which of the following compounds is optically active?
(A) 1-Bromobutane (B) 1-Bromo-2-methylpropane
(C) 2-Bromobutane (D) 2-Bromo-2-methylpropane

32. When cyclohexane is poured in water, it floats, because:
(A) Cyclohexane is in 'boat' form (B) Cyclohexane is less dense than water
(C) Cyclohexane is in 'chair' form (D) Cyclohexane is in 'crown' form

33. For the given reaction products **A** and **B** are, respectively:



(A)  and $H_2$ (B)  and $CH_3OH$

(C)  and $CH_3Br$ (D)  and $CH_3Br$

34. Mutarotation involves:
(A) Racemisation (B) Conformational inversion
(C) Diastereomerisation (D) Optical resolution

35. How many isomers are there of octahedral $[CrCl_2(OH_2)_4]^+$ and octahedral $[CoCl_2(en)_2]^+$ ?
(A) 2 for $[CrCl_2(OH_2)_4]^+$; 2 for $[CoCl_2(en)_2]^+$
(B) 2 for $[CrCl_2(OH_2)_4]^+$; 3 for $[CoCl_2(en)_2]^+$
(C) 3 for $[CrCl_2(OH_2)_4]^+$; 3 for $[CoCl_2(en)_2]^+$
(D) 3 for $[CrCl_2(OH_2)_4]^+$; 2 for $[CoCl_2(en)_2]^+$

36. For which pair of complexes is the order of values of $\Delta_{oct}$ correct?
(A) $[Fe(CN)_6]^{4-} > [Fe(CN)_6]^{3-}$
(B) $[Rh(NH_3)_6]^{3+} > [Co(NH_3)_6]^{3+}$
(C) $[Cr(OH_2)_6]^{2+} > [Cr(OH_2)_6]^{3+}$
(D) $[CrF_6]^{3-} > [Cr(CN)_6]^{3-}$

37. Which one of the following is expected to exhibit a Jahn-Teller distortion?
(A) $[Mn(OH_2)_6]^{3+}$
(B) $[Mn(CN)_6]^{3-}$
(C) $[Fe(CN)_6]^{2-}$
(D) $[Cr(OH_2)_6]^{3+}$

38. The $Y^{3+}$ ion is:
(A) hard, and favours ligands with N- and/or O-donor atoms
(B) hard, and favours ligands with S- and/or P-donor atoms
(C) soft, and favours ligands with S- and/or P-donor atoms
(D) soft, and favours ligands with N- and/or O-donor atoms

39. The reactions of $[PtCl_4]^{2-}$ with $NH_3$ (reaction I) and of $[PtCl_4]^{2-}$ with $[NO_2]^-$ followed by $NH_3$ (reaction II) are ways of preparing:

(A) I: trans-$[PtCl_2(NH_3)_2]$ ; II: trans-$[PtCl_2(NH_3)(NO_2)]^-$
(B) I: cis-$[PtCl_2(NH_3)_2]$ ; II: trans-$[PtCl_2(NH_3)(NO_2)]^-$
(C) I: cis-$[PtCl_2(NH_3)_2]$ ; II: cis-$[PtCl_2(NH_3)(NO_2)]^-$
(D) I: trans-$[PtCl_2(NH_3)_2]$ ; II: cis-$[PtCl_2(NH_3)(NO_2)]^-$

40. The ground state term symbol for $Eu^{3+}$ is:
(A) $_7F^0$
(B) $_7F^6$
(C) $_3F^0$
(D) $_3F^6$

41. Lanthanoid hydrides of formula $LnH_2$:
(A) contain the lanthanoid metal in oxidation state +2
(B) are electrically conducting materials
(C) possess 3-dimensional covalent structures
(D) are mixed valence Ln(I)/Ln(III) compounds

42. Which of the following series contains only paramagnetic metal ions?
(A) $La^{3+}$, $Ce^{3+}$, $Sm^{3+}$
(B) $Sm^{3+}$, $Ho^{3+}$, $Lu^{3+}$
(C) $Ce^{3+}$, $Eu^{3+}$, $Yb^{3+}$
(D) $La^{3+}$, $Gd^{3+}$, $Eu^{3+}$

43. Within the HSAB principle, a hard acid:
(A) has a low charge density
(B) shows a preference for soft bases
(C) is not very polarizable
(D) shows a preference for donor atoms of low electronegativity

44. For the substitution of one $H_2O$ ligand in $[Al(OH_2)_6]^{3+}$ by $F^-$, $\log K_1 = 6.10$ at 298 K. The value of $\Delta G_o$ for this process is:
(A) -34.8 kJ $mol^{-1}$
(B) -15.1 kJ $mol^{-1}$
(C) +34.8 kJ $mol^{-1}$
(D) +15.1 kJ $mol^{-1}$

45. Which of the following equilibria has the largest value of binding constant (K)?
(Hb= haemoglobin)
(A) $Hb + O_2 = Hb(O_2)$
(B) $Hb(O_2) + O_2 = Hb(O_2)_2$
(C) $Hb(O_2)_2 + O_2 = Hb(O_2)_3$
(D) $Hb(O_2)_3 + O_2 = Hb(O_2)_4$

46. Which of the following is tri-functional Siloxane?
(A) Dimethyl silicon chloride
(B) Trimethyl silicon chloride
(C) Tetramethyl silicon chloride
(D) Momethyl silicon chloride

47. Which of the following statements about fluorosulfonic acid, $HSO_3F$, is incorrect?
(A) $HSO_3F$ has a high dielectric constant
(B) A mixture of $HSO_3F$ and $SbF_5$ behaves as a superacid
(C) $HSO_3F$ is less viscous than $H_2SO_4$
(D) $HSO_3F$ cannot be handled in glass apparatus

48. $[Cr(CN)_6]^{3-}$ is expected to be:
(A) paramagnetic with $\mu_{eff} \approx 3.87$ μB
(B) diamagnetic
(C) paramagnetic with $\mu_{eff} < 3.87$ μB
(D) paramagnetic with $\mu_{eff} > 3.87$ μB

49. Which of the protein activates $Ca^{2+}$ pump?
(A) Troponin C
(B) Calmodulin
(C) Actin
(D) Tropomyosin

50. For high spin and low spin $d^6$ octahedral complex $ML_6$, the generally observed spin allowed transitions are
(A) two and one
(B) zero and one
(C) one and two
(D) two and two

51. Acetic acid in benzene solution forms dimer due to intermolecular H-bonding. For this case Van't Hoff factor is:
(A) $i = 1$ (B) $i > 1$
(C) $i < 1$ (D) inclusive

52. 90% of a first-order reaction completes in 90 minutes. 50% of the reaction will be over in approximately:
(A) 50 minutes (B) 54 minutes
(C) 27 minutes (D) 62 minutes

53. Time for completion of 75% of a reaction is thrice the time for completion of 50% of the same reaction. Hence, the order of the reaction is:
(A) 0 (B) 1
(C) 2 (D) 3

54. A cell reaction is spontaneous if:
(A) $E_{cell} > 0$ (B) $\Delta G \leq 0$
(C) $K > 1$ (D) all of these

55. Under which of the following conditions, $H_2$ has the highest entropy per mole?
(A) $H_2$ at 25 °C at 1 atm (B) $H_2$ at STP
(C) $H_2$ at 100 K at 1 atm (D) $H_2$ at 0 K at 1 atm

56. If the heat of formation of $C_6H_5$ (*l*), $H_2O$ (*l*) and $CO_2$ (*g*) are $-X_1$, $-X_2$ and $-X_3$ calories respectively, then heat of combustion of $C_6H_5$ (*l*) is,
(A) $X_1 - X_2 - X_3$ (B) $X_1 - 6X_2 - 3X_3$
(C) $X_1 + X_2 + X_3$ (D) $X_1 - 3X_2 - 6X_3$

57. Conjugate base of $HO_2^-$ is:
(A) $O_2^-$ (superoxide ion) (B) $H_2O_2$
(C) $O_2^{2-}$ (peroxide ion) (D) $O_2^+$

58. 'x' moles of lead acetate and 0.1 mole of acetic acid were taken in 1 litre solution to make a solution of pH = 5.04. The value of 'x' will be..... if $pK_a$ of $CH_3COOH$ is 4.74:
(A) 0.2 mole (B) 0.05 mole
(C) 0.1 mole (D) 0.02 mole

59. A solution containing 1 mole per litre each of $Cu(NO_3)_2$, $AgNO_3$, $Hg(NO_3)_2$ and $Mg(NO_3)_2$ is being electrolyzed by using inert electrodes. The values of the standard oxidation potentials in volts are $Ag/Ag^+ = -0.8$; $Hg/Hg^{2+} = -0.79$; $Cu/Cu^{2+} = -0.34$; $Mg/Mg^{2+} = 2.37$. The order in which metals will be formed at the cathode will be:
(A) Ag, Cu, Hg, Mg (B) Ag, Hg, Cu, Mg
(C) Ag, Hg, Cu (D) Cu, Hg, Ag

60. $E^\circ_{red}$ (standard reduction electrode potentials) of different half-cells are given:

$E^\circ_{Cu^{2+}/Cu} = 0.34$ V; $E^\circ_{Zn^{2+}/Zn} = -0.76$ V

$E^\circ_{Ag^{+}/Ag} = 0.80$ V; $E^\circ_{Mg^{2+}/Mg} = -2.37$ V

In which cell is $\Delta G^\circ$ is most negative?

(A) $Zn \mid Zn^{2+}(1M) \mid\mid Mg^{2+}(1M) \mid Mg$
(B) $Zn \mid Zn^{2+}(1M) \mid\mid Ag^{+}(1M) \mid Ag$
(C) $Cu \mid Cu^{2+}(1M) \mid\mid Ag^{+}(1M) \mid Ag$
(D) $Ag \mid Ag^{+}(1M) \mid\mid Mg^{2+}(1M) \mid Mg$

61. A catalyst accelerates the rate of reaction by:

(A) decreasing energy of activation.
(B) increasing Arrhenius constant
(C) increasing both energy of activation and Arrhenius constant
(D) decreasing both energy of activation and Arrhenius constant

62. Which of the following can act as a protective colloid?

(A) silica gel
(B) gelatin
(C) oil-in-water emulsion
(D) all of these

63. The class of voids that can existing in any close-packed structures are:

(A) trigonal, tetrahedral
(B) trigonal, octahedral
(C) tetrahedral, octahedral
(D) only octahedral

64. An electron trapped in an anion vacancy within the crystal is called:

(A) n-type conductor
(B) p-type conductor
(C) insulator
(D) F-centre

65. The ratio between the root mean square speeds of $H_2$ at 50 K and $O_2$ at 800 K, is:

(A) ¼
(B) 1
(C) 2
(D) 4

66. The r.m.s. velocity of hydrogen is $\sqrt{7}$ times the r.m.s. velocity of nitrogen. If T is the temperature of the gas then.

(A) $T(H_2) = T(N_2)$
(B) $T(H_2) > T(N_2)$
(C) $T(H_2) < T(N_2)$
(D) $T(H_2) = \sqrt{7}\, T(N_2)$

67. Which of the following is a natural fibre?

(A) Starch
(B) Rubber
(C) Cellulose
(D) Optical resolution

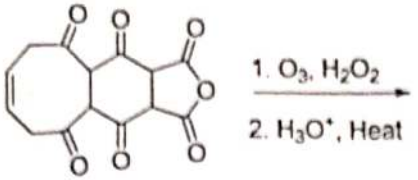
68. The reason for normalizing a wavefunction $\psi$ is:

(A) to guarantee that $\psi$ is square-integrable.
(B) to make $\psi^*\psi$ equal to the probability distribution function for the particle.
(C) to make $\psi$ an eigenfunction for the Hamiltonian operator.
(D) to make $\psi$ satisfy the boundary conditions for the problem.

69. Which of the following is not a condensation polymer?

(A) Glyptal
(B) Nylon-66
(C) Dacron
(D) PTFE

70. Total number of carbonyl groups present in the final product of the following reaction sequence are:




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

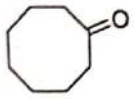
71. Which of the following will give aldol?

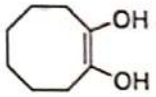
(A) Formaldehyde (B) Pivaldehyde
(C) Crotonaldehyde (D) Benzaldehyde

72. The IUPAC name of $C_6H_5COCl$ is:

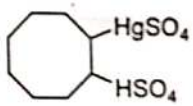
(A) Benzoyl chloride (B) Benzene carbonyl chloride
(C) Benzene chloro ketone (D) Chloro phenyl ketone

73. The reaction of cyclooctyne with $HgSO_4$ in presence of aq. $H_2SO_4$ gives:

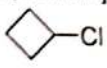
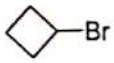
(A) 

(B) 


(C) 

(D) 


74. When 1-Bromo-3-chlorocyclobutane is treated with two equivalents of Na, in the presence of ether, it will produced.

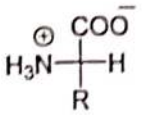
(A)  (B)  (C)  (D) 

75. The most appropriate sequence of reactions for carrying out the following conversion

(A) (i) Peracid; (ii) $H^+$; (iii) Zn / dil. HCl
(B) (i) Alkaline $KMnO_4$; (ii) $H^+$; (iii) Zn / dil. HCl
(C) (i) Alkaline $KMnO_4$; (ii) $NaIO_4$; (iii) $N_2H_4$ / KOH
(D) (i) $O_3$ / $Me_2S$; (ii) NaOEt; (iii) $N_2H_4$ / KOH

76. Which of the following is an example of basic dye?

(A) Alizarine (B) Indigo (C) Malachite (D) Orange-I

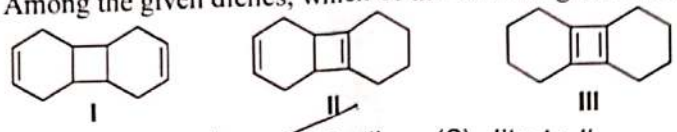
77. The pH of the solution containing following zwitterion  species is:

(A) 7 (B) 9 (C) 4 (D) 0

78. One letter code for 'Lysine' amino acid is:

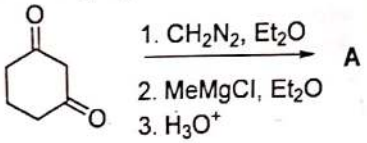
(A) L (B) K (C) R (D) Y

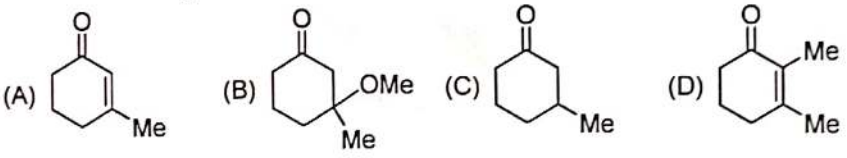
79. Among the given dienes, which of the following orders of stability is correct?



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

80. The major product 'A' formed in the following reaction sequence is:




81. During the addition polymerisation, the reaction proceeds via:

(A) Step-growth process (B) Free-radical chain reaction
(C) Cascade process (D) Addition reaction

82. In DNA the percentage of guanine is 23, what will be the percentage of thymine?

(A) 27 (B) 23 (C) 46 (D) 77

83. For the following reaction sequence what will be the overall percentage of D?

A $\xrightarrow{90\%}$ B $\xrightarrow{50\%}$ C $\xrightarrow{90\%}$ D

(A) 90% (B) 59.5% (C) 40.5 % (D) 50%

84. Which of the following atomic orbitals can overlap with an atomic orbital of the same type on an adjacent atom (both atoms lie on the x axis) to give a $\pi$ bond?

(A) $2p_x$ (B) $3d_{xy}$
(C) 2s (D) $3p_x$

85. In the emission spectrum of hydrogen, which series of emission lines falls in the visible region?

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

86. For which of the following elements, is the process of attaching the first electron the most exothermic?

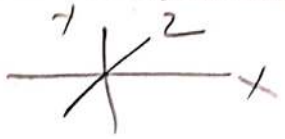
(A) O (B) H
(C) I (D) Na

87. In an MO diagram for the formation of $H_2O$ in which the z axis bisects the H–O–H angle:

(A) the O $2p_z$ atomic orbital interacts with an in-phase combination of H 1s atomic orbitals
(B) the O $2p_z$ atomic orbital interacts with an out-of-phase combination of H 1s atomic orbitals
(C) the O $2p_z$ atomic orbital is non-bonding
(D) the O 2s atomic orbital is non-bonding

88. An $X_2$ molecule lies so that the X nuclei are on the z axis. The bonding MO formed by the overlap of two $2p_x$ orbitals contains:

(A) no nodal planes
(B) one nodal plane
(C) a nodal plane between the nuclei
(D) two nodal planes



89. Which of the following statements is true about an $XY_2$ lattice?

(A) The coordination number of $X_2^{n+}$ is twice that of $Y^{n-}$
(B) The coordination number of $X_2^{n+}$ is half that of $Y^{n-}$
(C) The unit cell contains twice as many $X_2^{n+}$ ions as $Y^{n-}$
(D) The coordination environments of $X_2^{n+}$ and $Y^{n-}$ are the same

90. The coordination numbers of Ti(IV) and $O^{2-}$ in rutile are, respectively:

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

91. Which of the following statements is incorrect about oxalic acid ($H_2C_2O_4$) for which $K_{a(1)} = 5.9 \times 10^{-2}$ M and $K_{a(2)} = 6.4 \times 10^{-5}$ M?

(A) The observation that $K_{a(1)} > K_{a(2)}$ is general for dibasic acids
(B) Both $H_2C_2O_4$ and its conjugate base behave as weak acids
(C) $pK_{a(1)} > pK_{a(2)}$
(D) Oxalic acid forms salts including $Na_2C_2O_4$, $MgC_2O_4$ and $KHC_2O_4$

92. In neutral aqueous solution, $E^o$ for the $Mn^{3+}/Mn^{2+}$ couple is +1.54 V. At pH 14, $E^o$ for the $Mn(OH)_3/Mn(OH)_2$ couple is +0.15 V. Which of the following statements is incorrect?

(A) At pH 14, Mn(II) and Mn(III) both precipitate from aqueous solution as hydroxides
(B) Mn(III) is less stable with respect to reduction to Mn(II) at pH 14 than at pH 7
(C) The $Mn(OH)_3/Mn(OH)_2$ couple refers to an equilibrium involving Mn(III) and Mn(II)
(D) At pH 7, $Mn^{3+}(aq)$ is a relatively strong oxidizing agent

93. The enthalpy change for the dissociation: $M_2(g) \rightarrow 2M(g)$ is:

(A) more positive for $Li_2$ than for $K_2$
(B) more positive for $Rb_2$ than for $K_2$
(C) more positive for $Na_2$ than for $Li_2$
(D) more positive for $Cs_2$ than for $K_2$

94. $BeF_2$ dissolves in water to give $[Be(OH_2)n]^{2+}$ where:

(A) n = 2
(B) n = 3
(C) n = 4
(D) n = 6

95. In which reaction does the cluster core undergo a significant change in shape?
(A) $B_{10}H_{14} + C_2H_2 \rightarrow 1,2\text{-}C_2B_{10}H_{12} + 2H_2$
(B) $Cs_2[B_6H_6] + HCl \rightarrow Cs[B_6H_7] + CsCl$
(C) $B_5H_9 + KH \rightarrow K[B_5H_8] + H_2$
(D) $B_4H_{10} + CO \rightarrow 1\text{-}B_4H_8(CO) + H_2$

96. Which of the following statements is incorrect?
(A) $GeO_2$ dissolves in basic aqueous solution to give $[Ge(OH)_6]^{2-}$
(B) A $C_{60}$ molecule has $I_h$ symmetry
(C) $Pb(NO_3)_2$ and $PbO_2$ are both water soluble
(D) $^{119}Sn$ is an NMR active nucleus

97. Which reaction is unlikely to work?
(A) $AsF_3 + SbF_5 \rightarrow [AsF_2]^+ + [SbF_6]^-$
(B) $AlCl_3 + SbCl_5 \rightarrow [SbCl_4]+ + [AlCl_4]-$
(C) $SbCl_5 + 5HF \rightarrow SbF_5 + 5HCl$
(D) $2SbCl_3 + Cl_2 + 4CsCl \rightarrow 4Cs^+ + [SbCl_6]^- + [SbCl_6]^{3-}$

98. The following data are for solutions at pH 0:
$[S_2O_8]^{2-} + 2e^- \Leftrightarrow 2[SO_4]^{2-}$ ; $E^o = +2.01$ V
$[Cr_2O_7]^{2-} + 14H^+ + 6e^- \Leftrightarrow 2Cr^{3+} + 7H_2O$ ; $E^o = +1.33$ V
$[MnO_4]^- + 8H^+ + 5e^- \Leftrightarrow Mn^{2+} + 4H_2O$ ; $E^o = +1.51$ V

From the data, you can deduce that, at pH 0:
(A) $[S_2O_8]^{2-}$ will oxidize $Cr^{3+}$
(B) $[S_2O_8]^{2-}$ will reduce $[MnO_4]^-$
(C) $[SO_4]^{2-}$ will be oxidized by $[Cr_2O_7]^{2-}$
(D) $[S_2O_8]^{2-}$ will reduce $[Cr_2O_7]^{2-}$

99. Which of the following correctly describes the trends in values of Pauling electronegativities ($\chi_P$) and ionic radii ($r_{ion}$)?
(A) $\chi_P$: F < Cl < Br < I; $r_{ion}$: F < Cl < Br < I
(B) $\chi_P$: F > Cl > Br > I; $r_{ion}$: F < Cl < Br < I
(C) $\chi_P$: F < Cl < Br < I; $r_{ion}$: F > Cl > Br > I
(D) $\chi_P$: F > Cl > Br > I; $r_{ion}$: F > Cl > Br > I

100. Which statement about $FXeOSO_2F$ is incorrect?
(A) The environment about the Xe centre is linear
(B) The oxidation state of Xe is +2
(C) $FXeOSO_2F$ is an ionic salt
(D) $FXeOSO_2F$ can be prepared by treating $XeF_2$ with fluorosulfonic acid