OPSC
PGT
Previous Year Paper
(Chemistry)
03 Jul, 2022

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

T. B. C. : PGT – 3/20

Test Booklet Series

A

TEST BOOKLET

PART – B

(CHEMISTRY)

30353

Sl. No.

Time Allowed : 2 Hours

Maximum Marks : 100

: INSTRUCTIONS TO CANDIDATES :

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET OF THE SAME SERIES ISSUED TO YOU.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D**, AS THE CASE MAY BE, IN THE APPROPRIATE PLACE IN THE ANSWER SHEET USING BALL POINT PEN (BLUE OR BLACK).
3. You have to enter your **Roll No.** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
4. **YOU ARE REQUIRED TO FILL UP & DARKEN ROLL NO., TEST BOOKLET / QUESTION BOOKLET SERIES IN THE ANSWER SHEET AS WELL AS FILL UP TEST BOOKLET / QUESTION BOOKLET SERIES AND SERIAL NO. AND ANSWER SHEET SERIAL NO. IN THE ATTENDANCE SHEET CAREFULLY. WRONGLY FILLED UP ANSWER SHEETS ARE LIABLE FOR REJECTION AT THE RISK OF THE CANDIDATE.**
5. This Test Booklet contains **100** items (questions). Each item (question) comprises four responses (answers). You have to select the correct response (answer) which you want to mark (darken) on the Answer Sheet. In case, you feel that there is more than one correct response (answer), you should mark (darken) the response (answer) which you consider the best. In any case, choose **ONLY ONE** response (answer) for each item (question).
6. You have to mark (darken) all your responses (answers) **ONLY** on the **separate Answer Sheet** provided, by **using BALL POINT PEN (BLUE OR BLACK)**. See instructions in the Answer Sheet.
7. All items (questions) carry equal marks. All items (questions) are compulsory. Your total marks will depend only on the number of correct responses (answers) marked by you in the Answer Sheet. There will be no negative marking for wrong answer.
8. Before you proceed to mark (darken) in the Answer Sheet the responses (answers) to various items (questions) in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per the instructions sent to you with your **Admission Certificate**.
9. After you have completed filling in all your responses (answers) on the Answer Sheet and after conclusion of the examination, you should hand over to the Invigilator the *Answer Sheet* issued to you. You are allowed to take with you the candidate's copy / second page of the Answer Sheet along with the **Test Booklet**, after completion of the examination, for your reference.
10. Sheets for rough work are appended in the Test Booklet at the end.

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1. An ideal gas undergoes the process describe by equation $P = P_0 - aV^2$, where P_0, a are positive constants and V is the volume of one mole of gas. The maximum temperature attainable by the gas is :

(A) $2/3(P_0 / R)\sqrt{(P_0 / 3a)}$

(B) $3 P_0\sqrt{P_0} / 2Ra$

(C) $(1/3R)\sqrt{(P_0/3a)}$

(D) $4/3(P_0 / R)\sqrt{(P_0 / 2)}$

2. Suppose the temperature of gas is tripled and N_2 molecules dissociate into atom. Then what will be the rms speed of atom ?

(A) $v_0\sqrt{6}$

(B) $\sqrt{(6v_0)}$

(C) $v_0\sqrt{3}$

(D) $\sqrt{(3v_0)}$

3. For a first order reaction $A \rightarrow B$ the rate constant is x min^{-1}. If the initial concentration of A is 0.01 M, the concentration of A after one hour is given by the expression :

(A) e^{-x}

(B) $1 \times 10^{-2} (1-e^{-60x})$

(C) $(1 \times 10^{-2}) e^{-60x}$

(D) None of these

4. In a homogeneous reaction $A \rightarrow B + C + D$, the initial pressure was P_o and after time t is was P ; The expression of rate is :

(A) $k = \left(\frac{2.303}{t}\right) \log \left(\frac{2P_0}{3P_0 - P}\right)$

(B) $k = \left(\frac{2.303}{t}\right) \log \left(\frac{2P_0}{P_0 - P}\right)$

(C) $k = \left(\frac{2.303}{t}\right) \log \left(\frac{3P_0 - P}{2P_0}\right)$

(D) $k = \left(\frac{2.303}{t}\right) \log \left(\frac{2P_0}{3P_0 - 2P}\right)$

5. r_{max} and K_m for an enzyme catalyzed reaction are 2×10^{-3} $M.s^{-1}$ and 1.0 μM, respectively. The rate of reaction when substrate concentration is 1 μM is :

(A) $3 \times 10^{-3} s^{-1}$

(B) $1 \times 10^{-3} s^{-1}$

(C) $2 \times 10^{-3} s^{-1}$

(D) $0.50 s^{-1}$

6. The activation energies of two reactions are E_1 and E_2 ($E_1 > E_2$). If the temperature of the system is increased from T_1 to T_2, the rate constant of the reaction changes from k_1 to k_1' in the first reaction and k_2 to k_2' in the second reaction, predict which of the following expression is correct ?

(A) $(k_1'/k_1) > (k_2'/k_2)$

(B) $(k_1'/k_1) = (k_2'/k_2)$

(C) $(k_1'/k_1) = (k_2'/k_2) = 0$

(D) None of these

7. Oxidation of oxalic acid by acidified $KMnO_4$ is an example of auto catalysis. It is due to which of the following ?

(A) $KMnO_4$

(B) MnO_4^{-1}

(C) Mn^{2+}

(D) K^+

8. The half-reaction that occurs at the anode during the electrolysis of molten sodium bromide is :

(A) $2Br^- \rightarrow Br_2 + 2e^-$

(B) $Br_2 + 2e^- \rightarrow 2Br^-$

(C) $Na^+ + e^- \rightarrow Na$

(D) $Na \rightarrow Na^+ + e^-$

9. What mass (in g) of nickel could be electroplated from a solution of nickel(II) chloride by a current of 0.25 A flowing for 10 h ?

(A) 12 g

(B) 5.5 g

(C) 0.046 g

(D) 2.7 g

10. A vessel of volume V contains a mixture of 1 mole of hydrogen and 1 mole of oxygen (both considered as ideal). Let $f_1(v)dv$, denote the fraction of molecules with speed between v and (v + dv) with $f_2(v)dv$, similarly for oxygen. Then :

(A) $f_1(v) + f_2(v) = f(v)$ obeys the Maxwell's distribution law

(B) $f_1(v)$, $f_2(v)$ will obey the Maxwell's distribution law separately

(C) Neither $f_1(v)$, nor $f_2(v)$ will obey the Maxwell's distribution law

(D) $f_2(v)$ and $f_1(v)$ will be the same

11. For which of these systems is the system's energy conserved in every process ? (i) a closed system ; (ii) an open system ; (iii) an isolated system ; (iv) a system enclosed in adiabatic walls

(A) (i) and (ii)

(B) (ii) and (iv)

(C) (iii) only

(D) All of these

12. The translational energy is not possesed by :

(A) Water

(B) Cl_2 gas

(C) Ice

(D) Ar gas

13. Minimum value of molecular partition function for a degenerate system (g_i = degeneracy of the ith level) is :

(A) 0

(B) 1

(C) $\Sigma_i g_i$

(D) g_0

14. The pressure of a system in terms of partition function is :

(A) $p = Nk_BT\left(\frac{\partial \ln q}{\partial V}\right)_T$

(B) $p = Nk_BT\left(\frac{\partial \ln q}{\partial T}\right)_V$

(C) $p = Nk_BV\left(\frac{\partial \ln q}{\partial V}\right)_T$

(D) $p = Nk_BT\left(\frac{\partial \ln q}{\partial \ln V}\right)_T$

15. For a spontaneous change which of the following is correct ?

(A) $\Delta S_{sys} > 0$

(B) $\Delta S_{surr} > 0$

(C) $\Delta S_{univ} > 0$

(D) $\Delta G < 0$

16. Which of the following molecules belongs to the same symmetry group as NH_3 ?

(A) BF_3

(B) CH_4

(C) CH_3OH

(D) $CHCl_3$

17. The benzene molecule C_6H_6 has how many vibrational modes ?

(A) 6

(B) 12

(C) 24

(D) 30

18. The vapour pressure of a solution containing a non-volatile solute is directly proportional to the :

(A) Molality of the solvent

(B) Osmotic pressure of the solute

(C) Molarity of the solvent

(D) Mole fraction of solvent

19. A 250 mL solution containing 21.4 g of a polymer in toluene had an osmotic pressure of 0.055 atm at 27°C. What is the apparent formula weight of the polymer ?

(A) 15,000 $g.mol^{-1}$

(B) 18,000 $g.mol^{-1}$

(C) 26,000 $g.mol^{-1}$

(D) 38,000 $g.mol^{-1}$

20. For a particle in a box, which of the following is an incorrect statement ?

(A) The potential energy rises to infinity at the walls of the box

(B) All the wave functions possess nodes

(C) The energy levels are more closely spaced as the physical dimension of the system increases

(D) To energy levels are more closely spaced as the mass of the particle increases

21. Among the singlet (S), doublet (D) and triplet (T) states, the phosphorescence involves transition between :

(A) S and S

(B) S and T

(C) D and D

(D) T and T

22. If a capillary of radius 3×10^{-4} m is dipped vertically in a tube of water ($\gamma_{H_2O} = 72.75 \times 10^{-3}$ N m^{-1} ; d_{H_2O} = 998 kg m^{-3} and g = 9.807 m s^{-2}) at 25°C, the capillary rise will be :

(A) 0.0991 m

(B) 0.0496 m

(C) 0.4955 m

(D) 9.91 cm

23. The ascending order of Λ_m^0 values for NaOH, NaCl, CH_3COOH and HCl at a constant temperature is :

(A) $\Lambda^0_{m,HCl} > \Lambda^0_{m,NaOH} > \Lambda^0_{m,CH_3COOH} > \Lambda^0_{m,NaCl}$

(B) $\Lambda^0_{m,NaCl} < \Lambda^0_{m,NaOH} < \Lambda^0_{m,CH_3COOH} < \Lambda^0_{m,HCl}$

(C) $\Lambda^0_{m,HCl} > \Lambda^0_{m,NaOH} > \Lambda^0_{m,NaCl} > \Lambda^0_{m,CH_3COOH}$

(D) $\Lambda^0_{m,CH_3COOH} < \Lambda^0_{m,NaCl} < \Lambda^0_{m,NaOH} < \Lambda^0_{m,HCl}$

24. If 0.6 mole of O_2 reacts according to $3O_2 \rightarrow 2O_3$, the extent of reaction will be :

(A) 0.2 mol

(B) – 0.2 mol

(C) 0.6 mol

(D) – 0.6 mol

25. For a second order reaction $A \rightarrow P$, by what factor the half-life will change if the concentration of A is halved ?

(A) 1

(B) 2

(C) $\frac{1}{2}$

(D) $\frac{1}{4}$

26. Consider the following gaseous equilibria with equilibrium constants K_1 and K_2, respectively :

$SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$

$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$

The equilibrium constants are related are :

(A) $2K_1 = K_2^2$

(B) $K_1^2 = \frac{1}{K_2}$

(C) $K_2^2 = \frac{1}{K_1}$

(D) $K_2 = \frac{2}{K_1^2}$

27. Buffer solutions have constant acidity and alkalinity because :

(A) They have large excess of H^+ or OH^- ions

(B) They have fixed value of pH

(C) These give unionised acid or base on reaction with added acid or alkali

(D) Acids and alkalies in these solutions are shielded from attack by other ions

28. The triple point of a substance is :

(A) The temperature at which a non ideal gas behaves almost ideally

(B) The temperature and pressure at which the three phases (gas, liquid, and solid) of that substance co-exist in thermo-dynamic equilibrium

(C) The end point of a phase equilibrium curve

(D) A point where one stable state is changed to another stable state

29. The rate constant (k) for the reaction $[PtCl_4]^{2-} + OH^- \rightarrow P$ (products) varies with an increase in ionic strength of the solution in the following manner :

(A) k increases

(B) k decreases

(C) k does not change

(D) k increases initially, passes through a plateau and then decreases

30. Which of the following (for the same values of externally controlled conditions) is not a requirement for the occurrence of a chemical oscillation ?

(A) The system must be far from equilibrium

(B) The rate law of the reaction must be linear

(C) There must be at least two autocatalytic steps in the reaction mechanism

(D) The system must be able to exist in two stable steady states

31. The rate of the following reaction $2N_2O_5\,(g) = 4\,NO_2\,(g) + O_2\,(g)$ is :

(A) $-\frac{1}{4}\,d[NO_2]/dt$

(B) $-\frac{1}{2}\,d[N_2O_5]/dt$

(C) $2d[N_2O_5]/dt$

(D) $-d[O_2]/dt$

32. What is the correct order of λ_{max} for $\pi \rightarrow \pi^*$ transition for the following three compounds ?

(A) $R-C=C-R < R_2C=CR_2 <$ $R-CHO$

(B) $R-C=C-R > R_2C=CR_2 >$ $R-CHO$

(C) $R-C=C-R = R_2C=CR_2 =$ $R-CHO$

(D) $R-C=C-R < R_2C=CR_2 >$ $R-CHO$

33. The vibrations, without a center of symmetry are active in which of the following region ?

(A) Infrared but inactive in Raman

(B) Raman but inactive in IR

(C) Raman and IR

(D) Inactive in both Raman and IR

34. Which one of the following is the best radical scavenger to analyze the ESR spectra of a photogenerated electrovalent species ?

(A) p-benzoquinone

(B) $K_2S_2O_8$

(C) TEMPO

(D) DMPO

35. Alkene under high temperature and high-pressure forms _____.

(A) Alcohol

(B) Polyalkyne

(C) Polyalkane

(D) Polyalkene

36. Which of the following reagents is a good nucleophile ?

(A) NH_3

(B) BH_3

(C) Br_2

(D) HBr

37. What will be the major product if 1, 3-butadiene is treated with one mole of bromine at an elevated temperature ?

(A) 1, 2-dibromo-1-butene

(B) 1, 4-dibromo-2-butene

(C) 1, 3-dibromo-2-butene

(D) 1, 3-dibromo-1-butene

38. Which one of the following compounds will have two doublets, J = 16 Hz in its ^1H NMR spectrum ?

(A) 1, 1-dibromoethene

(B) 1-bromo-1-chloroethene

(C) (E)-1-bromo-2-chloroethene

(D) (Z)-1-bromo-2-chloroethene

39. The reagent which can be used to differentiate between glucose and fructose is :

(A) Fehling's solution

(B) Tollen's reagent

(C) Benedict's reagent

(D) Bromine water

40. N, N′-Dicyclohexylcarbodiimide is used as :

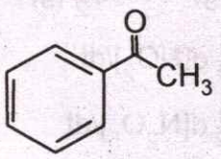
(A) A nucleophile

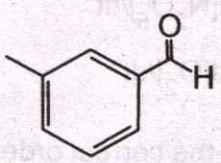
(B) A condensing agent

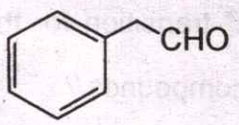
(C) An electrophile

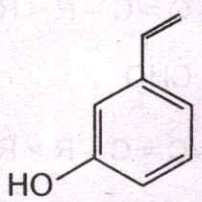
(D) A radical gènerator

41. An organic compound P (C_8H_8O) on nitration gives a mononitro derivative, which on treatment with Sn/HCl gives amino derivative. The product has the λ_{max} = 304 nm. Predict the structure of the compound (P) :

(A) 

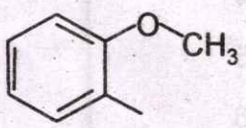
(B) 

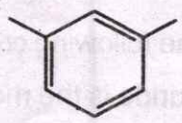
(C) 

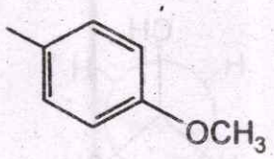
(D) 

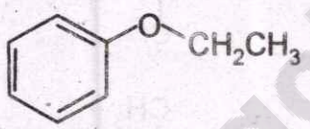
42. Which of the following compounds below most closely matches the following ^{1}H-NMR data :

δ-value	No. of protons	Splitting
7.6	2H	doublet
7.3	2H	doublet
3.5	3H	singlet
2.2	3H	singlet

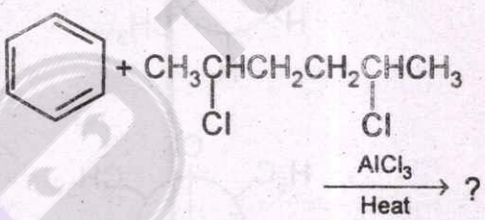
(A) 

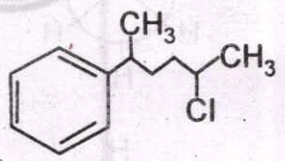
(B) 

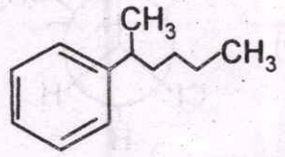
(C) 

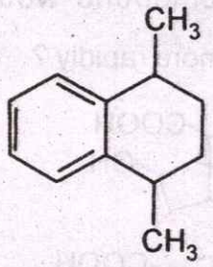
(D) 

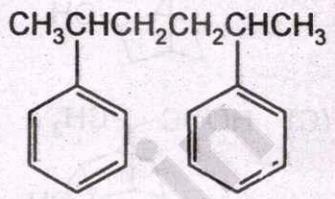
43. What product will be formed ?



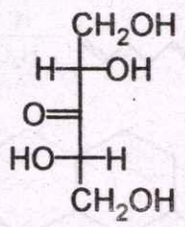
(A) 

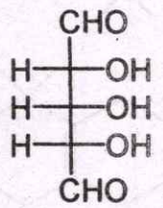
(B) 

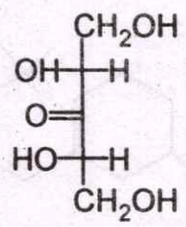
(C) 

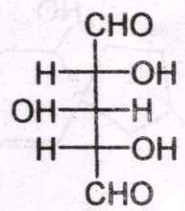
(D) 

44. A monosaccharide has been isolated having molar mass of 150 g.mol^{-1}. Suprisingly, it is not optically active. What is the structure of the monosaccharide ?

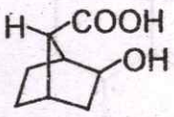
(A) 

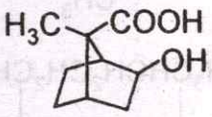
(B) 

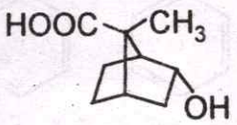
(C) 

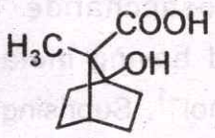
(D) 

45. What compound would form a lactone more rapidly ?

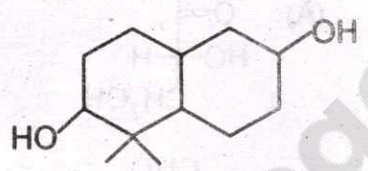
(A) 

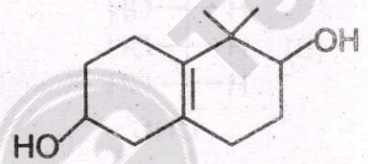
(B) 

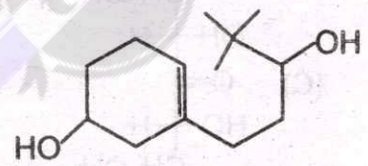
(C) 

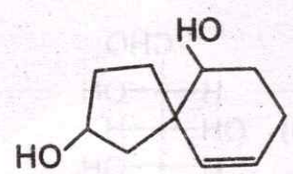
(D) 

46. Identify the product :

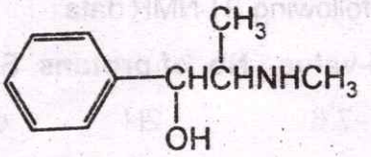
(A) 

(B) 

(C) 

(D) 

47. How many stereoisomers are possible for ephedrine ?



Ephedrine

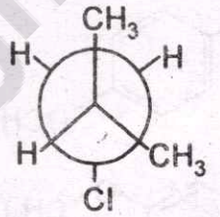
(A) 2

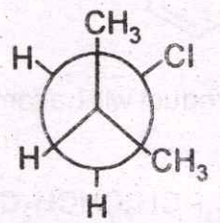
(B) 4

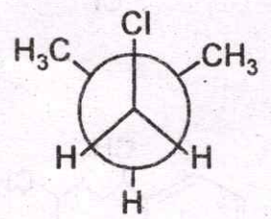
(C) 5

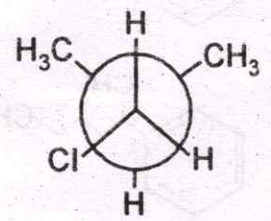
(D) 6

48. Which of the following conformers of isobutychloride is the most stable ?

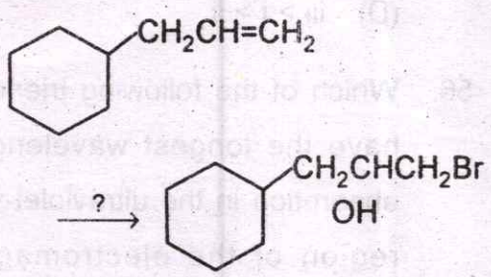
(A) 

(B) 

(C) 

(D) 

49. Give the reagents that would be required to carry out the following synthesis :



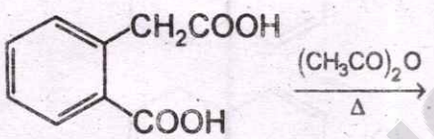
(A) HBr/Peroxide

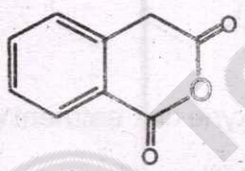
(B) Br_2/CCl H_2O_2

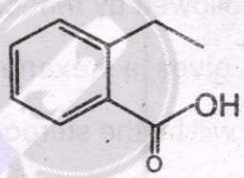
(C) NBS/Peroxide H_2O

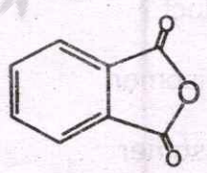
(D) Br_2/H_2O

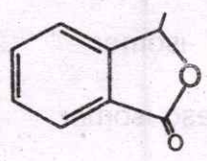
50. Mention the product of the following reaction :



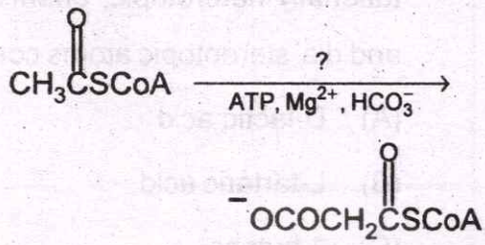
(A) 

(B) 

(C) 

(D) 

51. Name the enzyme that catalyses the following reaction and name the required co-enzyme :



(A) Acetyle-CoA carboxylase, biotin

(B) Lactate dehydrogenase, NADH

(C) Dihydrolipoyl dehydrogenase, FAD

(D) Propionyl-CoA carboxylase, biotin

52. Which statement is true ?

(A) D-Fructose reduces Fehling solution but sucrose does not

(B) Sucrose reduces Fehling solution but D-fructose does not

(C) Both of D-fructose and sucrose reduce Fehling solution

(D) None of D-fructose and sucrose reduces Fehling solution

53. In which one of the following molecules homotopic, constitutionally heterotopic, enantiotopic and dia-stereotopic atoms coexist ?

(A) D-lactic acid

(B) L-tartaric acid

(C) 1-butene

(D) 2-butene

54. Predict the outcome when 2R, 3R-3-bromo-2-butanol reacts with HBr :

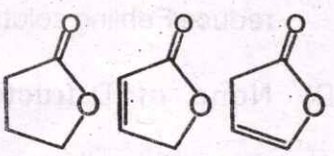
(A) Z-2-bromobutene

(B) An equimolecular mixture of Z-2-bromobutene and E-2-bromobutene

(C) 2S, 3R-2, 3-dibromobutane

(D) An equimolecular mixture of 2R, 3R-2, 3-dibromobutane and 2S, 3S-2, 3-dibromobutane

55. Arrange the following molecules in decreasing order of their carbonyl stretching frequencies :



i ii iii

(A) i > ii > iii

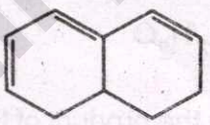
(B) i > iii > ii

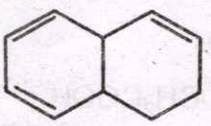
(C) iii > ii > i

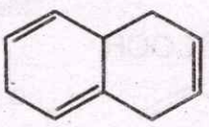
(D) iii > i > ii

56. Which of the following trienes will have the longest wavelength of absorption in the ultraviolet-visible region of the electromagnetic spectrum ?

(A) 

(B) 

(C) 

(D) 

57. 3-Hexyne on treatment with Na in liq. NH_3 followed by reduction with D_2, Pd/C gives a hexane derivative. What will be the stereochemistry of the product ?

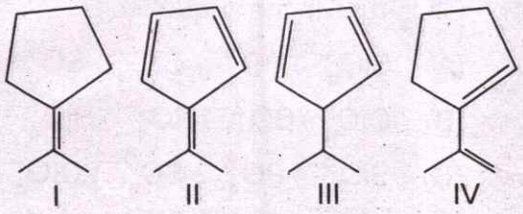
(A) ℓ-isomer

(B) d-isomer

(C) dℓ-isomer

(D) meso-isomer

58. Among the following hydrocarbons, the compound which can be reduced with $LiAlH_4$ is :

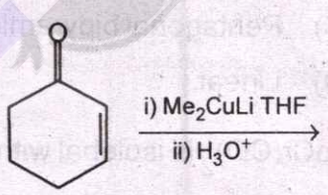


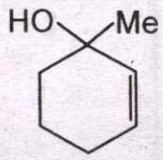
(A) I
(B) II
(C) III
(D) IV

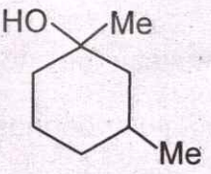
59. Pyridine can be converted to 4-nitropyridine by :

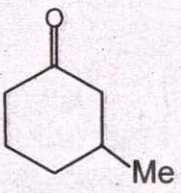
(A) Direct nitration of pyridine
(B) Reaction of pyridine with SO_3 in CH_2Cl_2 followed by treatment of the product with conc. HNO_3
(C) Reaction of pyridine with $NaNH_2$ followed by oxidation of the product with CF_3CO_3H
(D) Conversion of pyridine to pyridine N-oxide and then nitration followed by PCl_3 treatment

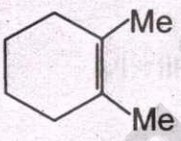
60. Predict the product in the following reaction :



(A) 

(B) 

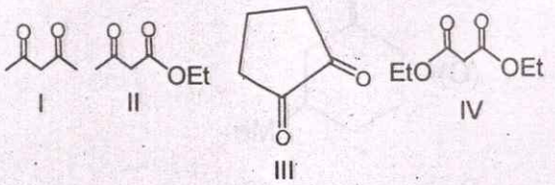
(C) 

(D) 

61. What kind of reagent is needed to resolve recemic 2-aminobutane ?

(A) A pure optically active amine to serve as a template for crystallization
(B) An achiral carboxylic acid to give a racemic mixture of amine salts
(C) An enantiometrically pure chiral carboxylic acid to give a diastereomeric mixture of amine salts
(D) A recemic carboxylic acid to give a complete mixture of isomeric amine salts

62. In the pure state, the enol content of the following compounds will follow the order :



I II III IV

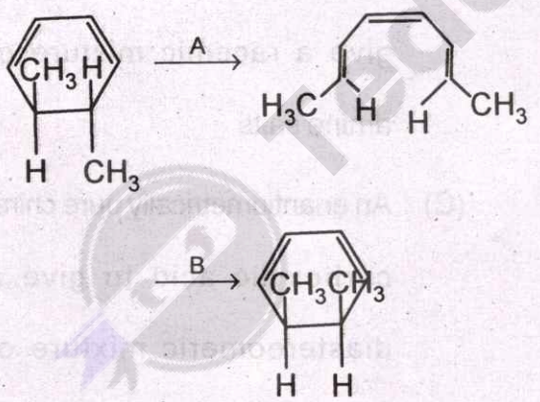
(A) I > II > III > IV

(B) I > III > IV > II

(C) III > I > II > IV

(D) II > III > IV > I

63. The conditions 'A' and 'B' required for the following pericyclic reactions are :



(A) A – Δ ; B – hv

(B) A – Δ ; B – Δ

(C) A – hv ; B – hv

(D) A – hv ; B – Δ

64. The d_π-p_π bonding efficiency of the oxyanions SiO_4^{4-}, PO_4^{3-}, SO_4^{2-} and ClO_4^- runs in the sequence :

(A) $SiO_4^{4-} \rangle PO_4^{3-} \rangle ClO_4^- \rangle SO_4^{2-}$

(B) $ClO_4^- \rangle SO_4^{2-} \rangle PO_4^{3-} \rangle SiO_4^{4-}$

(C) $SiO_4^{4-} \rangle PO_4^{3-} \rangle SO_4^{2-} \rangle ClO_4^-$

(D) $ClO_4^- \rangle PO_4^{3-} \rangle SO_4^{2-} \rangle SiO_4^{4-}$

65. The Lewis acid strength of $Al(CH_3)_3$, $B(CH_3)_3$ and $B(C_6H_5)_3$ follows the order :

(A) $B(CH_3)_3 \rangle Al(CH_3)_3 \rangle B(C_6H_5)_3$

(B) $B(CH_3)_3 \rangle B(C_6H_5)_3 \rangle Al(CH_3)_3$

(C) $Al(CH_3)_3 \rangle B(CH_3)_3 \rangle B(C_6H_5)_3$

(D) $B(C_6H_5)_3 \rangle Al(CH_3)_3 \rangle B(CH_3)_3$

66. The phosphazene molecule $(NPCl_2)_n$ is aromatic when the value of n is :

(A) 3

(B) 4

(C) Both 3 and 4

(D) 5

67. The structure of the anion $[Sb(C_2O_4)_3]^{3-}$ is :

(A) Octahedral

(B) Trigonal prismatic

(C) Pentagonal bipyramid

(D) Linear

68. $CpCr(CO)_2$ is isolobal with :

(A) CH^-

(B) CH_2

(C) CH_2^+

(D) CH

69. Among Mn^{2+}, V^{2+}, Ni^{2+} and Ti^{2+}, the cation having the highest hydration energy to form aqua complex $[M(H_2O)_6]^{2+}$ is :

(A) Mn^{2+}

(B) V^{2+}

(C) Ni^{2+}

(D) Ti^{2+}

70. The crystal field splitting pattern of the d-orbitals of a central metal ion in trigonal prismatic symmetry follows the energy order :

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

(B) $d_{x^2-y^2} \approx d_{xy} > d_{z^2} > d_{xz} \approx d_{yz}$

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

(D) $d_{xz} \approx d_{yz} > d_{x^2-y^2} \approx d_{xy} > d_{z^2}$

71. An octahedral metal ion M^{2+} has magnetic moment of 4.0 B. M. The correct combination of metal ion and d-electron configuration is given by :

(A) $Co^{2+}, t_{2g}^5 e_g^2$

(B) $Cr^{2+}, t_{2g}^4 e_g^2$

(C) $Mn^{2+}, t_{2g}^3 e_g^1$

(D) $Fe^{2+}, t_{2g}^4 e_g^2$

72. Compounds $K_2Ba[Cu(NO_2)_6]$ (A) and $Cs_2Ba[Cu(NO_2)_6]$ (B) exhibits tetragonal elongation and tetragonal compression, respectively. The unpaired electon in A and B are found respectively, in orbitals :

(A) d_{z^2} and $d_{x^2-y^2}$

(B) $d_{x^2-y^2}$ and d_{z^2}

(C) d_{z^2} and d_{z^2}

(D) $d_{x^2-y^2}$ and $d_{x^2-y^2}$

73. The observed higher moments of tetrahedral Co(II) is due to :

(A) Orbital contribution

(B) Spin-orbit coupling

(C) Both the orbital contribution and spin-orbit coupling

(D) Low spin state

74. Which of the following cations does not have orbital contribution to the magnetic moment with high spin configuration in an octahedral environment ?

(A) V^{3+}

(B) Cr^{3+}

(C) Co^{2+}

(D) Co^{3+}

75. A face-centered cubic lattice of identical solid spheres has the lattice parameter 4.2 Å. The radius of the sphere is :

(A) 1.48 Å

(B) 1.82 Å

(C) 2.15 Å

(D) 3.20 Å

76. In a cubic close packed arrangement of identical spheres the ratio of spheres to octahedral holes is :

(A) 1 : 0.5

(B) 1 : 1

(C) 1 : 2

(D) 1 : 1.5

77. The thermodynamic order of oxidizing power of the interhalogen compounds ClF_3, BrF_3 and IF_5 is :

(A) $ClF_3 > BrF_3 > IF_5$

(B) $ClF_3 < BrF_3 < IF_5$

(C) $ClF_3 > BrF_3 < IF_5$

(D) $ClF_3 < BrF_3 > IF_5$

78. The selectivity sequence of Crown–6 to the metal ions Li^+, Na^+ and K^+ is :

(A) $Li^+ > Na^+ > K^+$

(B) $K^+ > Na^+ > Li^+$

(C) $Na^+ > Li^+ > K^+$

(D) $K^+ > Li^+ > Na^+$

79. The iodometric titration in alkaline (pH > 8) medium gives erroneous result due to the formation of :

(A) IO^-

(B) IO_3^-

(C) Both IO^- and IO_3^-

(D) I_2

80. $MgSO_4$, on reaction with NH_4OH and Na_2HPO_4, forms a white crystalline precipitate. The precipatate is :

(A) $Mg(NH_4)PO_4$

(B) $Mg_3(PO_4)_2$

(C) $Mg(OH)_2$

(D) $MgHPO_4$

81. The uranocene $U(\eta^8 - C_8H_8)_2$ belongs to the point group :

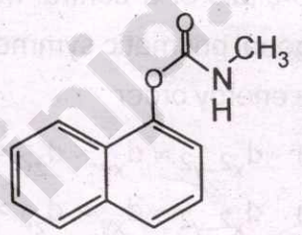
(A) D_{4h}

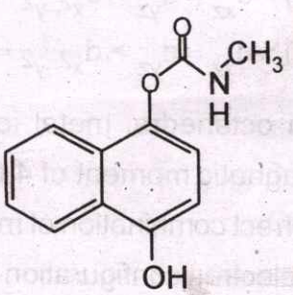
(B) D_{4d}

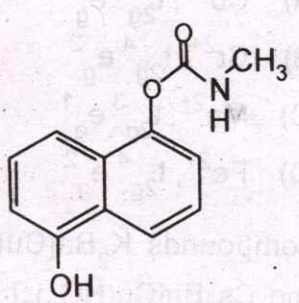
(C) D_{8h}

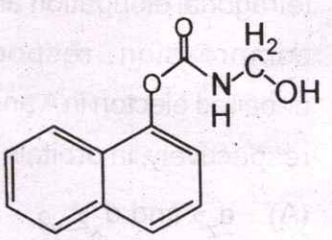
(D) D_{8d}

82. The culprit MIC gas that caused Bhopal disaster was used in the manufacture of the carbaryl :

(A) 

(B) 

(C) 

(D) 

83. If in an ore, ^{238}U ($t_{1/2} = 4.5 \times 10^9$ y) and ^{226}Ra ($t_{1/2} = 1.6 \times 10^3$ y) are in equilibrium, then the ratio of ^{238}U to ^{226}Ra will be :

(A) 1.54×10^{-2}

(B) 4.43×10^4

(C) 2.87×10^6

(D) 2.51×10^8

84. The pH of 0.24 mol. dm^{-3} $Al(ClO_4)_3$ solution (pK_a of $Al(aq)^{3+}$ = 4.85) is :

(A) 2.01

(B) 2.72

(C) 4.73

(D) 5.54

85. The pale green aqueous solution of commercial $CrCl_3.6H_2O$ on prolonged standing turns blue-violet due to the formation of :

(A) [**trans**-$CrCl_2(OH_2)_4$]Cl

(B) [**cis**-$CrCl_2(OH_2)_4$]Cl

(C) $[CrCl(OH_2)_5]Cl_2$

(D) $[Cr(OH_2)_6]Cl_3$

86. Which one of the following ions will show maximum paramagnetic moment ?

(A) $[Cr(H_2O)_6]^{3+}$

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

(C) $[Cu(H_2O)_6]^{2+}$

(D) $[Zn(H_2O)_6]^{2+}$

87. The correct order of hybridization of the central atom in the following species NH_3, $[PtCl_4]^2$, PCl_5 and BCl_3 is :

(A) dsp^2, dsp^3, sp^2 and sp^3

(B) sp^3, dsp^2, dsp^3 and sp^2

(C) dsp^2, sp^2, sp^3 and dsp^3

(D) dsp^2, sp^3, sp^2 and dsp^3

88. The compound which obeys 18-electron rule is :

(A) $V(CO)_6$

(B) $Cr(CO)_6$

(C) $Mn(CO)_3$

(D) $Fe(CO)_4$

89. The nitrogen oxide that does not contain N — N bond is :

(A) N_2O

(B) N_2O_3

(C) N_2O_4

(D) N_2O_5

90. The ground state of high-spin octahedral and tetrahedral Co(II) complexes are, respectively :

(A) $^4T_{2g}$ and $^4A_2$

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

(C) $^4T_{1g}$ and $^4A_2$

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

91. The radius of carbon atom in C_2H_2 and C_2H_6 is 0.60 and 0.77 Å, respectively, because :

(A) C_2H_2 is linear but C_2H_6 is non-linear

(B) C_2H_2 is more acidic than C_2H_6

(C) Hybrid orbitals of C_2H_2 is having more s-charater than that of the C_2H_6

(D) H-atoms always use 1s-orbital

92. Which of the following species is likely to be present in aqueous solution of iron(II) chloride in solution ?

(A) $[Fe(H_2O)_6]^{3+}$

(B) $[Fe(H_2O)_5(OH)]^{2+}$

(C) $[Fe(H_2O)_5(OH)]^{+}$

(D) $[Fe(H_2O)_4(OH)(Cl)]^{+}$

93. When $K_2Cr_2O_7$ is heated with conc. HCl, the reduction product is :

(A) $CrCl_3$

(B) Cl_2

(C) KCl

(D) H_2O

94. Which one of the following complexes does not have tetrahedral geometry ?

(A) $[Ni(NH_3)_4]^{2+}$

(B) $[Cu(CN)_4]^{3-}$

(C) $[NiCl_4]^{2-}$

(D) $[Ni(CN)_4]^{2-}$

95. $[NiCl_2(PPh_3)_2]$ is paramagnetic with μ_{eff} = 2.9 BM. All the ligands are monodentate. The geometry of the molecule is :

(A) Square planar

(B) Square pyramidal

(C) Octahedral

(D) Tetrahedral

96. Which of the following electrolytes will be most effective in the coagulation of gold gel ?

(A) $NaNO_3$

(B) $K_4[Fe(CN)_6]$

(C) Na_3PO_4

(D) $MgCl_2$

97. The replicate data of chromium content in a steel sample obtained from chemical analysis are 1.12, 1.15, 1.11, 1.16 and 1.12%. The standard deviation in the data is :

(A) ± 0.015%

(B) ± 0.022%

(C) ± 0.025%

(D) ± 0.031%

98. In a three electrode assembly, the potential is applied between :

(A) Working electrode and counter electrode

(B) Working electrode and reference electrode

(C) Reference electrode and counter electrode

(D) All of these

99. The check the reversibility of a redox process through Cyclic Voltammetry (CV) experiment, the essential plot is :

(A) Peak current versus scan rate

(B) Peak current versus square root of scan rate

(C) Peak current versus square of scan rate

(D) Logarithm of current versus logarithm of scan rate

100. Which of the following technique is suitable for bulk phase analysis of any material ?

(A) Raman spectra

(B) X-ray diffraction

(C) Energy dispersive X-ray analysis

(D) X-ray Photoelectron Spectroscopy

SPACE FOR ROUGH WORK