A

Paper – II

Chemical Sciences

Booklet Code

A

TEST BOOKLET NO.

Subject Code : 0 1

Roll No. :

(Figures as per admission card)

Roll No. (in words) : ____________________

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OMR Sheet No. :

Name and Signature of Invigilator/s

Signature : ____________________

Name : ____________________

Time : 2 Hours | Maximum Marks : 200

Number of Pages in this Booklet : 16 | Number of Questions in this Booklet : 100

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of hundred (100) multiple-choice type of questions.
3. At the commencement of examination, the test booklet will be given to you. In the first 5 minutes, you are requested **to open the booklet and compulsorily examine it as below** :
   (i) To have access to the Test Booklet, tear off the paper seal on the edge of the cover page. Do not accept a booklet without sticker seal or open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Test Booklet will be replaced nor any extra time will be given.**
   (iii) After the verification is over, the Test Booklet Number should be entered in the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example : (A) (B) ● (D)
   where (C) is the correct response.
5. Your responses to the questions are to be indicated in the **OMR Sheet kept inside this Booklet**. If you mark at any place other than in the circles, the OMR Sheet will not be evaluated.
6. Read the instructions given in OMR Sheet carefully. Fill the Booklet Code of Paper – II in OMR Sheet **Compulsorily**.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space provided for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. You have to return the OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must NOT carry it with you outside the Examination Hall.
10. You can take away test booklet and carbon copy of OMR Answer Sheet after the examination.
11. **Use only Blue/Black Ball point pen.**
12. **Use of any calculator, electronic gadgets or log table, etc. is prohibited.**
13. **There is no negative mark for incorrect answer.**

A

CHEMICAL SCIENCES
Paper – II

1. The density of ice is 0.917×10^3 kg m^{-3} and that of water is 0.9998×10^3 kg m^{-3}. Express the dependence of the melting point on the pressure. Assume $\Delta_{fus}H°$ to be pressure-independent and equal to 6.0095 kJmol^{-1}. At what pressure will ice melt at – 1.0°C ?

(A) 135 bar (B) 170 bar
(C) 72.5 bar (D) 35 bar

2. An electron is confined in a 1-D box of length 0.1 nm. Calculate its ground state energy in electron volts.

(A) 150.4 eV (B) 200.2 eV
(C) 100.1 eV (D) 400.4 eV

3. An enzyme is

(A) A protein that act as a catalyst
(B) A molecule which binds a receptor without activating it
(C) A molecule which act as a cofactor
(D) A biocatalyst that doesn't have amide bond

4. Which of the following is not a Neurotransmitter ?

(A) Acetylcholine (B) Noradrenaline
(C) Adrenaline (D) Dopamine

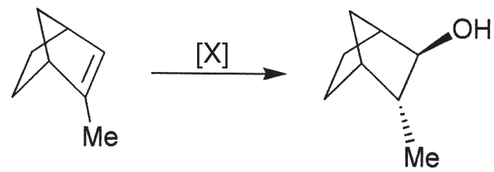
5. Hydroxy chloroquine is used for

(A) Anti malarial
(B) Anti viral
(C) Anti cancer
(D) Anti bacterial

6. Which reaction conditions would best convert 3-hexyne to cis-3-hexene ?

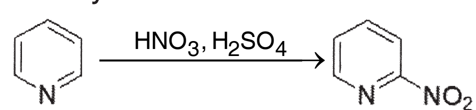
(A) Pt catalyst and H_2
(B) Lindlar's Pd catalyst and H_2
(C) Na in liquid NH_3
(D) $NaNH_2$ in liquid NH_3

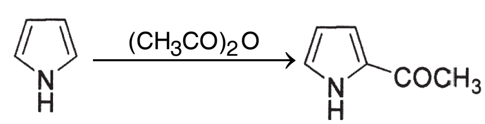
7. X in the following reaction is

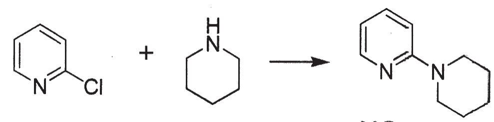


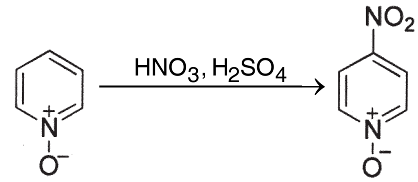
(A) aq. H_2SO_4
(B) $Hg(OAc)_2$ followed by reaction with $NaBH_4$/NaOH
(C) B_2H_6 followed by reaction with H_2O_2/NaOH
(D) *m*-CPBA followed by reaction with dil. H_2SO_4

8. Which of the following equations shows an unlikely result ?

(A) 

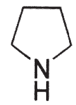
(B) 

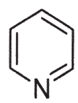
(C) 

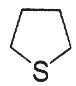
(D) 

9. Which is most reactive in electrophilic aromatic substitution ?

(A) 

(B) 

(C) 

(D) 

10. In the Kiliani-Fischer synthesis, the anomeric carbon of the starting carbohydrate

(A) remains as the carbonyl

(B) is lost as CO_2

(C) becomes the new epimeric stereocenter

(D) becomes a nitrile carbon

11. Combustion analysis of an organic compound shows it to be 64.3% carbon. It displays a molecular ion at m/z = 112 amu in the mass spectrum. Which of the following is a plausible molecular formula for this compound ?

(A) C_8H_{16} (B) $C_7H_{12}O$

(C) $C_6H_8O_2$ (D) $C_5H_4O_3$

12. Hybridization in XeF_4 is

(A) sp^3 (B) dsp^2

(C) sp^3d^2 (D) sp^3d

13. The number of Ni-Ni bonds in $[CpNi(\mu\text{-}PPh_2)]_2$ complex obeying the 18 electron rule is

(A) 0 (B) 1

(C) 2 (D) 3

14. What will be the correct number of Mössbauer lines for the $K_4[Fe(CN)_6]$ in the absence and presence of external magnetic field respectively ?

(A) one and two (B) one and six

(C) six and one (D) two and six

15. Which one of the following statements are true for atom having following reaction in its nucleus ?

$_1P^1 \rightarrow {}_0n^1 + {}_1\beta^0$

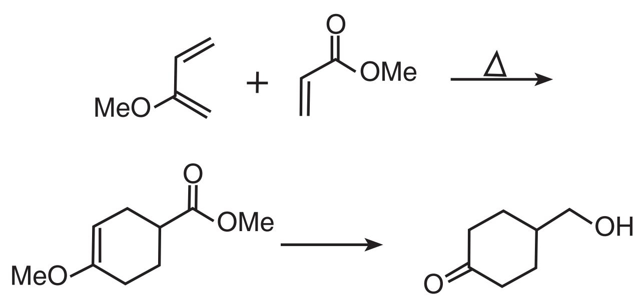
(A) Its mass number increases by 1

(B) Its isotope is formed

(C) Its neutron number decreases by 1

(D) Its atomic number decreases by 1

16. 4-Hydroxymethylcyclohexanone can be synthesized from a Diels-Alder adduct in the following reactions. Which combination of reagents is appropriate for the second step ?



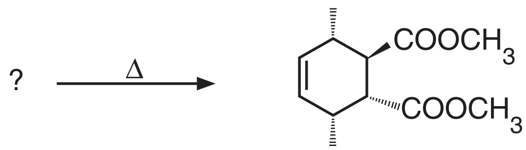
(A) $NaBH_4$/MeOH; and H_3O^+

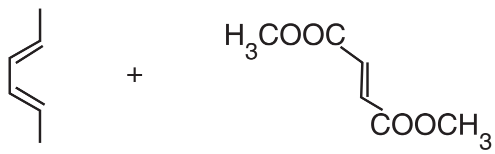
(B) $NaBH_4$/THF; and NaOH/H_2O

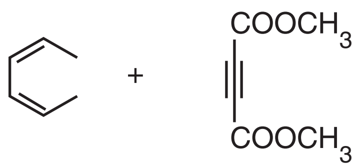
(C) $LiAlH_4/Et_2O$; and H_3O^+

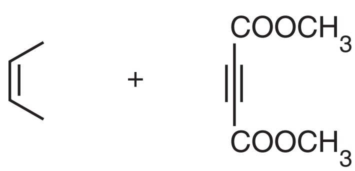
(D) $LiAlH_4/Et_2O$; and NaOH/H_2O

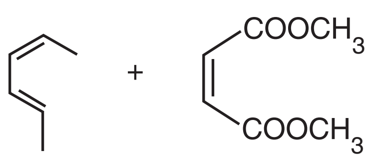
17. What are the reactants needed to accomplish the following reaction ?



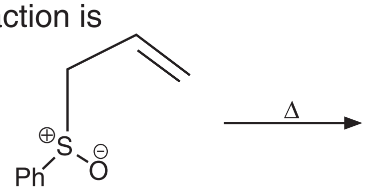
(A) 

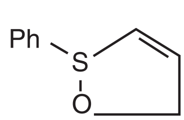
(B) 

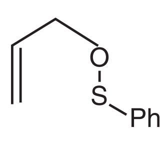
(C) 

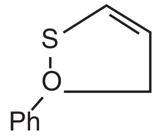
(D) 

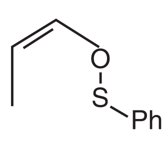
18. The major product of the following reaction is



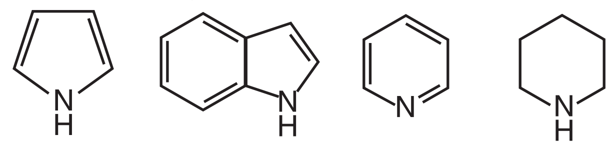
(A) 

(B) 

(C) 

(D) 

19. The correct order of the basicity of following compounds is



I II III IV

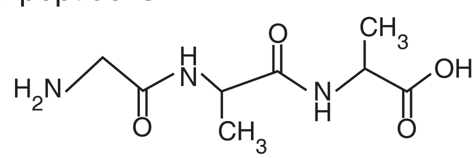
(A) IV > III > II > I

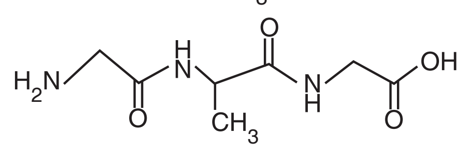
(B) III > IV > I > II

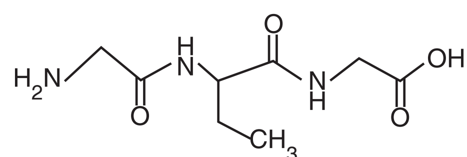
(C) IV > III > I > II

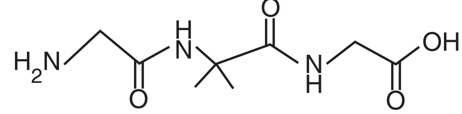
(D) III > IV > II > I

20. A tripeptide is written as Glycine-Alanine-Glycine. The correct structure of tripeptide is

(A) 

(B) 

(C) 

(D) 

21. The complex that shows orbital contribution to magnetic moment is

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

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

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

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

22. Identify those with zero dipole moment

i. $SiCl_4$
ii. $POCl_3$
iii. NF_3
iv. trans-$[SnCl_4(py)_2]$

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

23. Removal of electron from NO molecule results in

i. an increase in frequency of NO in the IR spectrum.
ii. an EPR active species.
iii. electrons in HOMOs being closer to the oxygen than to nitrogen 2p-orbitals.
iv. electrons in HOMOs being closer to the nitrogen than to oxygen 2p-orbitals.

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

24. Identify the species, those obey 18 electron rule, from the following :

i. Cu(Cp)(CO)
ii. $Mn(Cp)(CO)_2$
iii. $Cr(Cp)(CO)_3$
iv. $V(Cp)(CO)_4$

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

25. **Assertion** : Second period consist of 8 elements.

Reason : Number of elements in each period is four times the number of atomic orbitals available in the energy level that is being filled.

(A) If both assertion and reason are true, and reason is the correct explanation of the assertion
(B) If both assertion and reason are true, and reason is not the correct explanation of the assertion
(C) If assertion is true, but reason is false
(D) If both assertion and reason are false

26. Match the following.

Column – I	Column – II
P. Coulometry	1. Current efficiency
Q. Ion selective electrode	2. Dead stop end point
R. Polarography	3. Dropping mercury electrode
S. Amperometry	4. Membrane potential

(A) P-1, Q-4, R-3, S-2
(B) P-1, Q-3, R-2, S-4
(C) P-1, Q-2, R-4, S-3
(D) P-4, Q-3, R-1, S-2

27. The d-orbital will split under trigonal bipyramidal field into

(A) 2 (B) 3
(C) 4 (D) 5

28. The number of lines exhibited by a high resolution EPR spectrum of the species, $[Cu(ethylenediamine)_2]^{2+}$ is [Nuclear spin (I) of Cu = 3/2 and that of N = 1]

(A) 12 (B) 15

(C) 20 (D) 36

29. The product of the reaction of propene, CO and H_2 in the presence of $Co_2(CO)_8$ as a catalyst is

(A) butanoic acid

(B) butanal

(C) 2-butanone

(D) methylpropanoate

30. Reductive elimination step in hydrogenation of alkenes by Wilkinson catalyst results in (neglecting solvent in coordination sphere of Rh)

(A) T-shaped $[Rh(PPh_3)_2Cl]$

(B) Trigonal-planar $[Rh(PPh_3)_2Cl]$

(C) T-shaped $[Rh(H)(PPh_3)_2]$

(D) Trigonal-planar $[Rh(H)(PPh_3)_2]$

31. Compared with a conjugated diene, the UV-visible absorption spectrum of a conjugated triene will change in which way ?

(A) the λ_{max} will increase and the ε will decrease

(B) the λ_{max} will decrease and the ε will increase

(C) both the λ_{max} and the ε will decrease

(D) both the λ_{max} and the ε will increase

32. The ^1H NMR spectrum of a diluted solution of a mixture of acetone and dichloromethane in $CDCl_3$ exhibits two singlets of 1 : 1 intensity. Molar ratio of acetone to dichloromethane in the solution is

(A) 3 : 1

(B) 1 : 3

(C) 1 : 1

(D) 1 : 2

33. The correct statement about *cis* and *trans*-stilbene is

(A) *trans*-stilbene has higher coupling constant than *cis*-stilbene

(B) *cis*-stilbene has higher coupling constant than *trans*-stilbene

(C) vinylic proton of *trans*-stilbene are more deshielded

(D) vinylic proton of *cis*-stilbene are more deshielded

34. An unknown compound has a molecular ion at m/z = 79 amu in its mass spectrum. Analysis shows its composition to be 17.7% nitrogen. What is the molecular formula of this compound ?

(A) C_5H_5N

(B) $C_4H_3N_2$

(C) C_3HN_3

(D) $C_4H_{17}N$

35. Neopentyl chloride, $(CH_3)_3CCH_2Cl$, reacts with the strong base sodium amide to form a new compound. This compound has a molecular ion at m/z = 70 amu and displays two ^1H NMR singlets at δ 0.20 and 1.05 ppm (intensity ratio = 2 : 3). What is a plausible structure for this compound ?

(A) 2-methyl-2-butene

(B) 1, 1-dimethylcyclopropane

(C) Methylcyclobutane

(D) Cyclopentane

36. Under which circumstance would the free energy change for a reaction be relatively temperature independent ?

(A) $\Delta H°$ is negative

(B) $\Delta H°$ is positive

(C) $\Delta S°$ has a large positive value

(D) $\Delta S°$ has a small value

37. If the energy of a particle can be either 1, 2, 3 or 4 units with probability 1/10, 2/10, 3/10 and 4/10 respectively, the average energy of the particle is

(A) 0.5 (B) 3.0

(C) 3.7 (D) 4.3

38. In aqueous solution, iodide ion (in basic solution) is oxidized by hypochlorite ion :

$OCl^-(aq) + I^-(aq) \rightarrow OI^-(aq) + Cl^-(aq)$

The rate of formation of hypoiodite, OI^-, is given by the rate law

rate = $(k[OCl^-][I^-])/[OH^-]$

What is the overall reaction order for the formation of OI^- ?

(A) 1 (B) 2

(C) 3 (D) 4

39. What will be the ionic strength of a solution prepared by mixing 50 ml of 0.2 M KNO_3, 20 ml of 0.15 M K_2SO_4 and 30 ml of 0.05 M $Cu(NO_3)_2$?

(A) 0.502 M (B) 0.398 M

(C) 0.205 M (D) 0.229 M

40. At a certain wavelength, the fluorescence quantum yield and observed fluorescence lifetime of tryptophan in water are 0.20 and 2.6 ns respectively. What is the fluorescence rate constant K_f ?

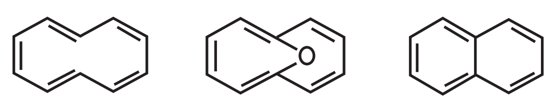
(A) $7.7 \times 10^7\ s^{-1}$

(B) $9.8 \times 10^9\ s^{-1}$

(C) $1.2 \times 10^{-8}\ s^{-1}$

(D) $6.7 \times 10^{-8}\ s^{-1}$

41. Identify the aromatic compound(s) amongst I to III.



I II III

(A) I, II and III

(B) I and II only

(C) II and III only

(D) I and III only

42. Arndt-Eistert synthesis involves one of the following rearrangements

(A) Curtius rearrangement

(B) Von-Pechmann rearrangement

(C) Lossen rearrangement

(D) Wolff rearrangement

43. What is the reactive intermediate formed in the elimination-addition mechanism of nucleophilic aromatic substitution ?

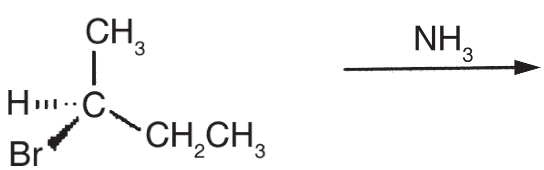
(A) Free radical

(B) Carbocation

(C) Carbanion

(D) Benzyne

44. Which of the following statements describes the nucleophilic substitution product obtained from the following reaction of S-2-bromobutane with ammonia in a non-polar solvent ?



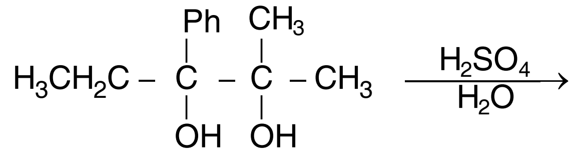
(A) This reaction yields R-2-aminobutane as the major substitution product

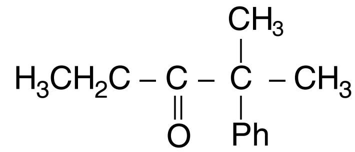
(B) This reaction yields S-2-aminobutane as the major substitution product

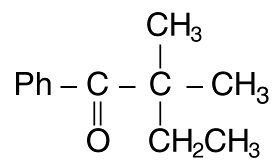
(C) This reaction yields a racemic mixture as the major substitution products

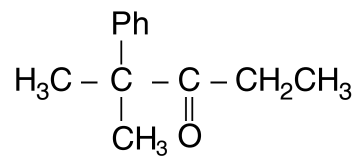
(D) No reaction takes place

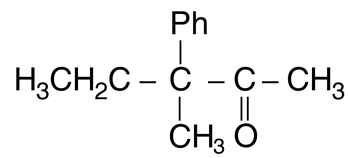
45. Which carbonyl compound is the main product of the following reaction of a diol ?



(A) 

(B) 

(C) 

(D) 

46. A particle in a box of dimension L has a wave function $\psi(x) = A \sin kx$ for a box which extends from 0 to L. The wave function would be $\psi(x) = B \cos kx$ if the box is between ------

(A) $x = -L \rightarrow x = 0$

(B) $x = L \rightarrow x = 2L$

(C) $x = L/2 \rightarrow x = 3L/2$

(D) $x = -2L \rightarrow x = -L$

47. Consider a normalized molecular orbital

$$\psi = c\varphi_1 - \frac{i}{\sqrt{2}}\varphi_2$$

constructed from two different atomic orbitals φ_1 and φ_2 that form an orthonormal set. The value of $|c^2|$ is

(A) 1/2 (B) $1/\sqrt{2}$

(C) $\sqrt{2}$ (D) 2

48. Which of the following transitions is not allowed by the electric dipole selection rules ?

(A) $^2S_{1/2} \rightarrow {}^2P_{3/2}$

(B) $^2S_{1/2} \rightarrow {}^2P_{1/2}$

(C) $^2S_{1/2} \rightarrow {}^2D_{3/2}$

(D) $^1P_1 \rightarrow {}^1D_2$

49. Which of these molecules (X_2) would you expect to be stabilized by the addition of an electron to form X_2^- ?

(A) H_2 (B) Li_2

(C) C_2 (D) N_2

50. The π-molecular orbital $\frac{1}{2}\chi_1 - \frac{1}{\sqrt{2}}\chi_2 + \frac{1}{2}\chi_3$ for the allyl radical transforms as

	E	**C_2**	**σ_v (xz)**	**σ_v(yz)**
A_1	1	1	1	1
A_2	1	1	–1	–1
B_1	1	–1	1	–1
B_2	1	–1	–1	1

(A) A_1 (B) A_2

(C) B_1 (D) B_2

51. The complex $[Mn(H_2O)_6]^{2+}$ has very light pink color. The best reason for it is

(A) the complex does not have a charge transfer transition

(B) d-d transitions here are orbital forbidden but spin allowed

(C) d-d transitions here are spin forbidden but orbital allowed

(D) d-d transitions here are both orbital forbidden and spin forbidden

52. In compound $N_3P_3F_6$, the geometry around nitrogen and phosphorus respectively are

(A) Pyramidal and tetrahedral

(B) Planar and tetrahedral

(C) Pyramidal and planar

(D) Planar and trigonal bipyramidal

53. The correct statement regarding terminal/bridging CO groups in solid $Co_4(CO)_{12}$ and $Ir_4(CO)_{12}$ is

(A) Both have equal number of bridging CO groups

(B) Number of bridging CO groups in $Co_4(CO)_{12}$ is 4

(C) The number of terminal CO groups in $Co_4(CO)_{12}$ is 8

(D) Number of bridging CO groups in $Ir_4(CO)_{12}$ is zero

54. In the cluster $[Co_3(CH)(CO)_9]$ obeying $18e^-$ rule, no. of M-M bond and bridging ligand

(A) 3 and 1CH

(B) 0 and 3CO

(C) 3 and 1CO

(D) 6 and 1CH

55. HOMO (highest occupied molecular orbital) to LUMO (lowest unoccupied molecular orbital) electronic transition responsible for the observed colours of halogen molecules (gas) is

(A) $\pi^* \rightarrow \sigma^*$ (B) $\pi \rightarrow \pi^*$

(C) $\sigma \rightarrow \sigma^*$ (D) $\pi \rightarrow \sigma^*$

56. For a 1 molal KCl solution, the mean ionic activity coefficient ($\gamma\pm$) is related to the Debye Hückel limiting law constant (A) as

(A) $\ln \gamma\pm = \sqrt{2}\ A$ (B) $\log \gamma\pm = -\sqrt{2}\ A$

(C) $\gamma\pm = 10^{A}$ (D) $\gamma\pm = 10^{-A}$

57. Which one of the following has the highest coagulating power for ferric hydroxide sol ?

(A) Al^{3+} (B) Na^{+}

(C) SO_4^{2-} (D) PO_4^{3-}

58. The term symbol for the ground state of B_2 is $^3\Sigma_g^-$. The total spin and total orbital angular momentum are respectively

(A) ½, 0 (B) ¾, 0

(C) 1, 0 (D) 2, 1

59. How many modes of vibration are possible for a benzene molecule ?

(A) 6 (B) 12

(C) 30 (D) 31

60. If 1*s*A(1) is an atomic 1s orbital containing electron 1 on hydrogen atom A, then which of the following terms would not appear in the valence bond wave function for the H_2 molecule ?

a. 1*s*A(1) 1*s*A(2)

b. 1*s*A(1) 1*s*B(2)

c. 1*s*B(1) 1*s*A(2)

d. 1*s*B(1) 1*s*B(2)

(A) a, c and d

(B) c and d

(C) a only

(D) a and d

61. Which one of the reaction is not expected to occur on the basis of HSAB concept ?

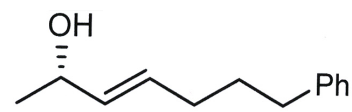
(A) $NaF + HCl \rightarrow NaCl + HF$

(B) $CaCl_2 + 2F^- \rightarrow CaF_2 + 2Cl^-$

(C) $HgCl_2 + 2F^- \rightarrow HgF_2 + 2Cl^-$

(D) $MgO + H_2O \rightarrow Mg(OH)_2$

62. The IUPAC name for the compound given below is



(A) (2R, 3Z)-7-phenylhept-3-en-2-ol

(B) (2S, 3Z)-7-phenylhept-3-en-2-ol

(C) (2R, 3E)-7-phenylhept-3-en-2-ol

(D) (2S, 3E)-7-phenylhept-3-en-2-ol

63. Simon-Smith reaction is related with

(A) Carbene (B) Carbanion

(C) Nitrene (D) Xanthene

64. Correct match of Column – I and Column – II is

Column – I (Organic compound)	Column – II (Stretching frequency cm^{-1})
P. Acetone	1. 1800
Q. Ethyl acetate	2. 1660
R. Acetamide	3. 1740
S. Acetyl chloride	4. 1715

(A) P-4, Q-3, R-2, S-1

(B) P-1, Q-3, R-2, S-4

(C) P-1, Q-2, R-4, S-3

(D) P-4, Q-3, R-1, S-2

65. Which of the following dimethylcyclobutanes is chiral ?

(A) *trans*-1,2-dimethylcyclobutane

(B) *cis*-1,2-dimethylcyclobutane

(C) *trans*-1,3-dimethylcyclobutane

(D) *cis*-1,3-dimethylcyclobutane

66. The melting point of particles in nano form

(A) Increases

(B) Decreases

(C) Remains same

(D) Increases then decreases

67. The most harmful air pollutant produces by automobile is

(A) HNO_2

(B) NO

(C) SO_2

(D) CO

68. The lowest energy term for d^6 configuration

(A) ^2D (B) ^5D

(C) ^1P (D) ^1D

69. The reason of chemical inertness of gaseous nitrogen at room temperature is best given by its

(A) High bonding energy only

(B) Electronic configuration

(C) HOMO-LUMO gap only

(D) High bond energy and HOMO-LUMO gap

70. In oxy-hemoglobin, the iron centre is best described by which of the following ?

(A) High spin Fe(III)

(B) High spin Fe(II)

(C) Low spin Fe(II)

(D) Low spin Fe(III)

71. Which of the following molecules does not show a pure rotational microwave absorption spectrum ?

(A) NO_2 (B) N_2

(C) N_2O (D) NH_3

72. The EPR spectrum of methyl radical shows

(A) 1 line (B) 3 lines

(C) 4 lines (D) 12 lines

73. Use the following data for the enthalpies of formation ($\Delta H°$) of NO(g) and NO_2(g)

$(1/2)\ N_2(g) + (1/2)\ O_2(g) \rightarrow NO(g)$ $90.2\ kJ\ mol^{-1}$

$(1/2)\ N_2(g) + O_2(g) \rightarrow NO_2(g)$ $33.2\ kJ\ mol^{-1}$

to calculate $\Delta H°$ for the reaction

$NO(g) + (1/2)\ O_2(g) \rightarrow NO_2(g)$

(A) $-57.0\ kJ\ mol^{-1}$

(B) $-28.5\ kJ\ mol^{-1}$

(C) $+28.5\ kJ\ mol^{-1}$

(D) $+57.0\ kJ\ mol^{-1}$

74. What are the number of components and the number of degrees of freedom, respectively, in

$FeO(g) + CO(g) \rightleftharpoons Fe(s) + CO_2(g)$?

(A) 3, 2 (B) 4, 3

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

75. The equation for the evaluation of β in the Maxwell-Boltzmann distribution law is

(A) $\beta = 1/k_BT$

(B) $\beta = -1/k_BT$

(C) $\beta = k_BT$

(D) $\beta = 2/k_BT$

76. In the hydrolysis of *trans*-$[Co(en)_2ClA.]^+$, if the leaving group is chloride, the formation of *cis* product is the least, when A is

(A) NO_2^- (B) $-NCS^-$

(C) Cl^- (D) $-OH^-$

77. For OH^- catalysed S_N^1 conjugate base mechanism of $[Co(NH_3)_5Cl]^{2+}$, the species obtained in the first step of the reaction is/are

(A) $[Co(NH_3)_5(OH)]^{2+} + Cl^-$

(B) $[Co(NH_3)_4(NH_2)Cl]^+ + H_2O$

(C) $[Co(NH_3)_4(NH_2)]^{2+} + Cl^-$

(D) $[Co(NH_3)_5Cl(OH)]^+$ only

78. The number of 3c – 2e bonds present in $Al(BH_4)_3$ is

(A) four (B) three

(C) six (D) zero

79. The structures of XeF_2 and XeO_2F_2 respectively are

(A) bent, tetrahedral

(B) linear, square planar

(C) linear, see-saw

(D) bent, see-saw

80. The reagent(S) that can selectively precipitate S^{2-} from mixture of S^{2-} and SO_4^{2-} in aqueous solution is (are)

(A) $CuCl_2$

(B) $BaCl_2$

(C) $Pb(COOCH_3)_2$

(D) $Na_2[Fe(CN)_5NO]$

81. Configurations of a chiral molecule can be changed by

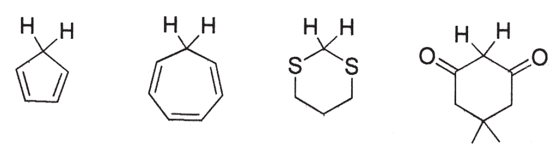
(A) Rotation around a sigma bond

(B) Cooling at 73° K

(C) Breaking a bond at chiral centre and reforming it

(D) Reacting it with an acid

82. Arrange the following compounds in decreasing order of acidity.



(P) (Q) (R) (S)

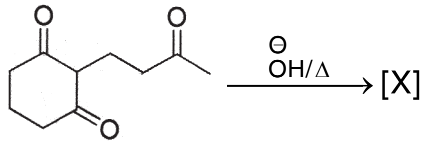
(A) S > P > Q > R

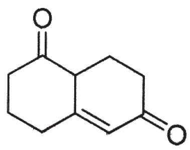
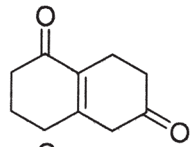
(B) P > S > R > Q

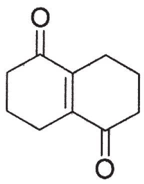
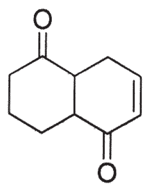
(C) R > P > S > Q

(D) P > Q > R > S

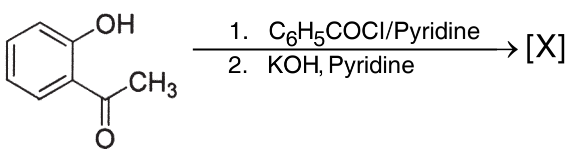
83. What is the product [X] of the following reaction ?

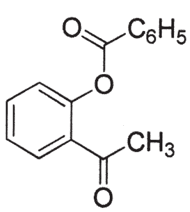


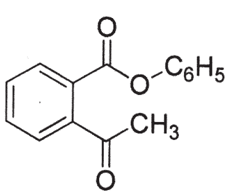
(A)  (B) 

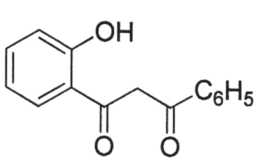
(C)  (D) 

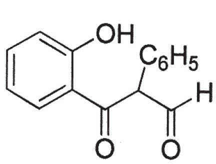
84. The product [X] in the following reaction is



(A) 

(B) 

(C) 

(D) 

85. Epoxidation of (R)-cyclohex-2-enol with peracetic acid yields mixture of compound A and B in the ratio of 95 : 5. Compound A and B are

(A) Enantiomers

(B) Diastereomers

(C) Constitutional isomers

(D) Regioisomers

86. The force constant of HF molecule is 970 Nm^{-1}. What will be the fundamental vibrational frequency of the given molecule ?

(A) $0.523 \times 10^{14}\ s^{-1}$

(B) $2.484 \times 10^{14}\ s^{-1}$

(C) $1.247 \times 10^{14}\ s^{-1}$

(D) $1.427 \times 10^{14}\ s^{-1}$

87. The parameters of an orthorhombic unit cell are a = 50 pm, b = 100 pm and c = 150 pm. What will be the spacing between (123) planes ?

(A) 30 (B) 29

(C) 32 (D) 25

88. The translational partition function for Ar confined to a volume of 1L at 300K, having thermal wavelength of 1.60×10^{-11}m is close to

(A) 24.4×10^{29}

(B) 2.44×10^{29}

(C) 0.244×10^{29}

(D) 244.0×10^{29}

89. The g-factor for the benzene radical anion, $C_6H_6^-$ is 2.0025. At what magnetic field intensity, its EMR spectrum will appear in a spectrometer operating at 9.302 GHz ?

(A) 303.0 mT

(B) 331.9 mT

(C) 359.2 mT

(D) 398.2 mT

90. The first excited state ($^2P_{1/2}$) of fluorine lies at an energy of 400 cm^{-1} above the ground state ($^2P_{3/2}$). The fraction of fluorine atoms in the first excited state at k_BT = 420 cm^{-1} is close to

(A) $\frac{1}{1+e}$

(B) $\frac{1}{1+2e}$

(C) $\frac{1}{1+4e}$

(D) $\frac{1}{2+e}$

91. **Assertion** : Ce^{4+} is used as an oxidizing agent in volumetric analysis.

Reason : Ce^{4+} has the tendency to attain +3 oxidation state.

(A) If both assertion and reason are true, and reason is the correct explanation of the assertion

(B) If both assertion and reason are true, and reason is not the correct explanation of the assertion

(C) If assertion is true, but reason is false

(D) If both assertion and reason are false

92. **Assertion** : The $[Ni(en)_3]Cl_2$ has lower stability than $[Ni(NH_3)_6]Cl_2$.

Reason : In $[Ni(en)_3]Cl_2$, the geometry of Ni is trigonal bipyramidal.

(A) If both assertion and reason are true, and reason is the correct explanation of the assertion

(B) If both assertion and reason are true, and reason is not the correct explanation of the assertion

(C) If assertion is true, but reason is false

(D) If both assertion and reason are false

93. **Assertion** : $K_2[Ni(EDTA)]$ is more stable than $K_3[Al(C_2O_4)_3]$.

Reason 1 : Ni is transition element while Al is non-transition element.

Reason 2 : In $[Ni(en)_3]Cl_2$, the geometry of Ni is trigonal bipyramidal.

(A) If both assertion and reason are true, and reason is the correct explanation of the assertion

(B) If both assertion and reason are true, and reason is not the correct explanation of the assertion

(C) If assertion is true, but reason is false

(D) If both assertion and reason are false

94. Match the following :

Column – I	Column – II
P. $(PPh_3)_3RhCl$	1. Hydroformylation of alkenes
Q. $[Rh(CO)_2I_2]^-$	2. Hydrogenation catalyst
R. $[PdCl_4]^{2-}$	3. The Wacker process
S. $[HCo(CO)_4]$	4. Monsanto catalyst for acetic acid

(A) P-1, Q-2, R-3, S-4
(B) P-2, Q-4, R-3, S-1
(C) P-1, Q-2, R-4, S-3
(D) P-4, Q-3, R-1, S-2

95. Match the following :

Column – I	Column – II
P. Magic number	1. Nuclear fission
Q. Liquid drop model of nucleus	2. Q-value
R. Actinides	3. Radioactivity
S. Threshold energy	4. Shell model of nucleus

(A) P-1, Q-2, R-3, S-4
(B) P-4, Q-3, R-2, S-1
(C) P-1, Q-2, R-4, S-3
(D) P-4, Q-1, R-3, S-2

96. A solution of 2.0 M formic acid (HCOOH) is 0.95% ionized. What is the K_a of formic acid ?

(A) 1.9×10^{-2} (B) 1.8×10^{-4}
(C) 9.0×10^{-5} (D) 4.5×10^{-5}

97. What is the activation energy for a reaction if its rate doubles when the temperature is raised from 20 °C to 35 °C ? ($R = 8.314\ J\ K^{-1}\ mol^{-1}$; $\ln 2 = 0.693$)

(A) 342 kJ mol^{-1} (B) 269 kJ mol^{-1}
(C) 34.7 kJ mol^{-1} (D) 15.1 kJ mol^{-1}

98. A plane in a crystal intersects the axes at 2a, 3b and 3c. The Miller indices of the plane are

(A) (123) (B) (233)
(C) (322) (D) (122)

99. A sample of atactic polystyrene is separated into 5 fractions

Fraction	Number of molecules	Molecular weight
1	20	10,000
2	20	20,000
3	20	30,000
4	20	40,000
5	20	50,000

The number average molecular weight (M_n) is

(A) 2.33×10^4 (B) 3.00×10^4
(C) 3.67×10^4 (D) 4.33×10^4

100. Which of the following is both a greenhouse gas and a fuel ?

(A) carbon dioxide
(B) coal
(C) freon
(D) methane

Space for Rough Work