Test Booklet Code & Serial No.
प्रश्नपत्रिका कोड व क्रमांक

A

Paper-II
CHEMICAL SCIENCE

Signature and Name of Invigilator

1. (Signature) .....

(Name) .....

2. (Signature) .....

(Name) .....

Seat No. | | | | | | | |

(In figures as in Admit Card)

Seat No. .....

(In words)

OMR Sheet No. | | | | | | | |

(To be filled by the Candidate)

JUN - 33225

Time Allowed : 2 Hours] **[Maximum Marks : 200**

Number of Pages in this Booklet : **44**

Number of Questions in this Booklet : **100**

Instructions for the Candidates

1. Write your Seat No. and OMR Sheet No. in the space provided on the top of this page.
2. This paper consists of **100** objective type questions. Each question will carry *two* marks. *All* questions of Paper II will be compulsory.
3. At the commencement of examination, the question booklet will be given to the student. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as follows :
   (*i*) To have access to the Question Booklet, tear off the paper seal on the edge of this 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 missing pages/questions or questions repeated or not in serial order or any other discrepancy should not be accepted and correct booklet should be obtained from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given. The same may please be noted.
   (*iii*) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each question 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 : where (B) is the correct response.

   Following wrong methods should not be used as they are not recognised by scanning machine in digitized assessment. Candidate using such method will be responsible for their loss.

5. Your responses to the items are to be indicated in the **OMR Sheet given inside the Booklet only.** If you mark at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done at the end of this booklet.
8. If you write your Name, Seat Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.
9. You have to return original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry the Test Booklet and duplicate copy of OMR Sheet on conclusion of examination.
10. Use only Blue/Black Ball point pen.
11. Use of any calculator or log table, etc., is prohibited.
12. There is no negative marking for incorrect answers.

विद्यार्थ्यांसाठी महत्त्वाच्या सूचना

1. परीक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात लिहावा. तसेच आपणांस दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
2. सदर प्रश्नपत्रिकेत 100 बहुपर्यायी प्रश्न आहेत. प्रत्येक प्रश्नास **दोन** गुण आहेत. या प्रश्नपत्रिकेतील **सर्व** प्रश्न सोडविणे अनिवार्य आहे.
3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनिटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात.
   (*i*) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्वीकारू नये.
   (*ii*) पहिल्या पृष्ठावर नमूद केल्याप्रमाणे प्रश्नपत्रिकेची एकूण पृष्ठे तसेच प्रश्नपत्रिकेतील एकूण प्रश्नांची संख्या पडताळून पहावी. पृष्ठे कमी असलेली/कमी प्रश्न असलेली/प्रश्नांचा चुकीचा क्रम असलेली किंवा इतर त्रुटी असलेली सदोष प्रश्नपत्रिका सुरुवातीच्या 5 मिनिटातच पर्यवेक्षकाला परत देऊन दुसरी प्रश्नपत्रिका मागवून घ्यावी. त्यानंतर प्रश्नपत्रिका बदलून मिळणार नाही तसेच वेळही वाढवून मिळणार नाही याची कृपया विद्यार्थ्यांनी नोंद घ्यावी.
   (*iii*) वरीलप्रमाणे सर्व पडताळून पाहिल्यानंतरच प्रश्नपत्रिकेवर ओ.एम.आर. उत्तरपत्रिकेचा नंबर लिहावा.
4. प्रत्येक प्रश्नासाठी (A), (B), (C) आणि (D) अशी चार विकल्प उत्तरे दिली आहेत. त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा/निळा करावा.
   उदा. : जर (B) हे योग्य उत्तर असेल तर.

   खालील चुकीच्या पद्धती वापरू नये, कारण डिजिटाइज्ड (Digitized) मूल्यांकनात स्कॅनिंग मशीन त्यांना ओळखत नाही. त्या पद्धती वापरून नुकसान झाल्यास त्यास विद्यार्थीच जबाबदार असतील.

5ए या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे **ओ.एम.आर. उत्तरपत्रिकेतच दर्शवावीत.** इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
6ए आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
7ए प्रश्नपत्रिकेच्या शेवटी जोडलेल्या कोऱ्या पानावरच कच्चे काम करावे.
8ए जर आपण ओ.एम.आर. वर नमूद केलेल्या ठिकाणाव्यतिरिक्त इतर कोठेही नाव, आसन क्रमांक, फोन नंबर किंवा ओळख पटेल अशी कोणतीही खूण केलेली आढळून आल्यास अथवा असभ्य भाषेचा वापर किंवा इतर गैरमार्गांचा अवलंब केल्यास विद्यार्थ्याला परीक्षेस अपात्र ठरविण्यात येईल.
9ए परीक्षा संपल्यानंतर विद्यार्थ्याने मूळ ओ.एम.आर. उत्तरपत्रिका पर्यवेक्षकांकडे परत करणे आवश्यक आहे. तथापि, प्रश्नपत्रिका व ओ.एम.आर. उत्तरपत्रिकेची द्वितीय प्रत आपल्याबरोबर नेण्यास विद्यार्थ्यांना परवानगी आहे.
10ए फक्त निळ्या किंवा काळ्या बॉल पेनचाच वापर करावा.
11ए कॅलक्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही.
12ए चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही.

Chemical Science

Paper II

Time Allowed : 120 Minutes] **[Maximum Marks : 200**

Note : This paper contains **Hundred (100)** multiple choice questions. Each question carrying **Two (2)** marks. Attempt *All* questions.

1. The property measured in derivative thermogravimetric analysis (DTG) is :

   (A) Change in weight

   (B) Rate of change in weight

   (C) Heat evolved

   (D) Change in temperature

2. The species that contain a vacant $d_{x^2-y^2}$ orbital is :

   (A) $[Ni(en)_3]^{2+}$ (en = $NH_2CH_2CH_2NH_2$)

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

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

   (D) $[Ni(CO)_4]$

3. $FeCl_2 \cdot 4H_2O$ and $FeCl_3 \cdot 6H_2O$ can be distinguished by ^{57}Fe Mössbauer spectroscopy. The *INCORRECT* statement from the following is :

   (A) Both compounds are high spin

   (B) Quadrupole splitting of $FeCl_2 \cdot 4H_2O$ is higher than that of $FeCl_3 \cdot 6H_2O$

   (C) Both compounds show the same isomer shift

   (D) The isomer shift of $FeCl_2 \cdot 4H_2O$ is higher than that of $FeCl_3 \cdot 6H_2O$

4. The solutions of (*i*) $[Cr(OH_2)_6]^{3+}$ ions are pale blue-green, but the chromite ion (*ii*) $[CrO_4]^{2-}$ is an intense yellow due to :

(A) d-d transitions in (*i*) and (*ii*)

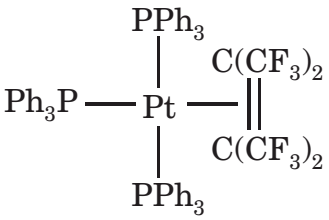
(B) d-d transition in (*i*) and charge transfer transition in (*ii*)

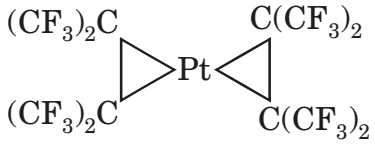
(C) Charge transfer transition in (*i*) and d-d transition in (*i*)

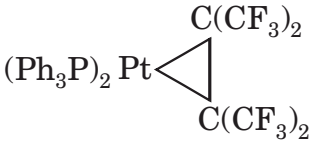
(D) Charge transfer in (*i*) and (*ii*)

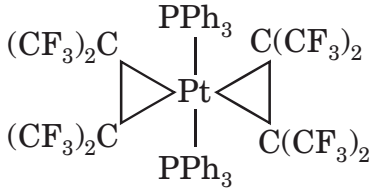
5. The major product of the following reaction in :

$(Ph_3P)_4\ Pt \xrightarrow{C_2(CF_3)_4}$

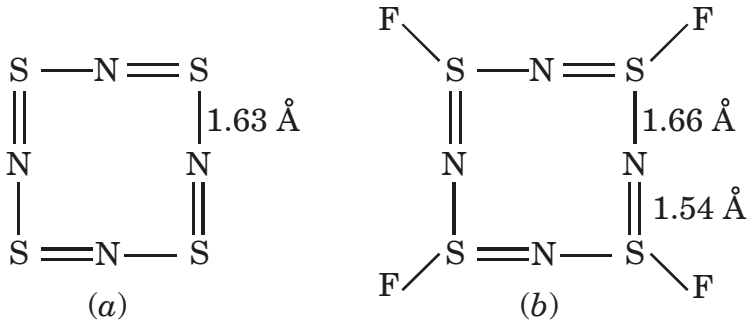
(A) 

(B) 

(C) 

(D) 

6. The structures of tetrasulphur tetranitride (a) and tetrathiazyl tetrafluoride (b) are given below. The statement that correctly describes the structures is :



(A) Both, (a) and (b), show extensive delocalization

(B) Compound (a) satisfies Hückel rule and is more stable than (b)

(C) Compound (b) satisfies Hückel rule and is more stable than (a)

(D) Both are aromatic ring systems

7. In an axially symmetric field, the first NQR transition energy for $I = \frac{3}{2}$ is :

(A) $\frac{-e^2Qq}{4}$

(B) $\frac{+e^2Qq}{4}$

(C) $\frac{+e^2Qq}{2}$

(D) $\frac{-e^2Qq}{20}$

8. In the ^{19}F NMR spectrum of ClF_3, the number of signals and multiplicity at room temperature are $\left(^{19}F; I = \frac{1}{2}\right)$:

(A) Two, a doublet and a triplet

(B) Two, doublets

(C) Two, a singlet and a doublet

(D) One, quartet

9. Between NF_3 and NH_3 :

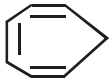
(A) NF_3 has a higher bond angle than NH_3 due to long N–F bond distance

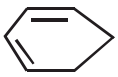
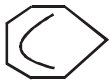
(B) NF_3 has a higher bond angle than NH_3 due to an ionic N-F bond

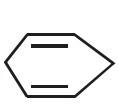
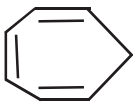
(C) NF_3 has a higher bond angle than NH_3 because NH_3 is less basic than NF_3

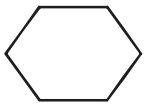
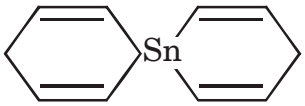
(D) NH_3 has a higher bond angle than NF_3 because NF_3 is less basic than NH_3

10. Identify (X) and (Y) in the following transformation

(A) X =  $Sn(n-Bu)_2$ Y =  $Sn(n-Bu)_2$

(B) X =  $Sn(n-Bu)_2$ Y =  $Sn(n-Bu)_2$

(C) X =  $Sn = CH_2$ Y =  $Sn = CH_2$

(D) X =  $Sn(n-Bu)_2$ Y = 

11. The oxyacids of sulphur having direct S-S bonds are :

(A) $H_2S_2O_3$, $H_2S_2O_4$, $H_2S_2O_7$ (B) $H_2S_2O_3$, $H_2S_2O_4$, $H_2S_2O_6$

(C) $H_2S_2O_6$, $H_2S_2O_7$, $H_2S_2O_8$ (D) $H_2S_2O_4$, $H_2S_2O_6$, $H_2S_2O_8$

12. The point group of Cis – $[PtCl_2(NH_3)_2]$ is :

(A) C_2h (B) C_2v

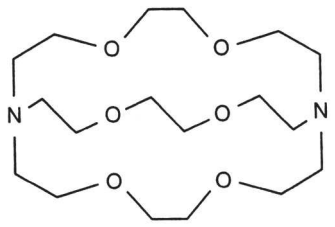
(C) D_2h (D) Td

13. Covalent multinuclear bonds are found in the solid state structures of :

(A) MeLi (B) $HgMe_2$

(C) WMe_6 (D) $PbMe_4$

14. Alkali metals form strong complexes with cryptate ligands. The structure of one such crypt given below is of :



(A) 4.2.2 crypt (B) 6.2.2 crypt

(C) 2.2.2 crypt (D) 8.6.2 crypt

15. Iron-enterobactin [Fe (ent)]$^{3-}$ complex has a dissociation content of 10^{-49} at pH = 7. Calculate the number of uncomplexed Fe^{3+} ions in a litre of 1 M solution in water at pH = 7.

(A) 10^{49} (B) Less than 1

(C) 10 (D) 10^{7}

16. Analysis of four different samples of an alloy yielded 12.12, 12.14, 12.10 and 12.22% of metal. The mean deviation of the result is :

(A) –0.0750 (B) 0.0375

(C) 0.1500 (D) 0.0255

17. The set containing all linear polyhalogen compounds is :

(A) I_3^-, Cl_3^-, $BrCl_2^-$ (B) ICl_2^-, I_3^+, Cl_3^+

(C) I_3^+, Cl_3^+, $BrCl_2^-$ (D) Cl_3^-, $BrCl_2^+$, ICl_2^-

18. The radionuclide ^{229}Th belongs to the :

(A) Thorium decay series (B) Uranium decay series

(C) Actinium decay series (D) Neptunium decay series

19. A particular metal complex has an electronic configuration of $np^1\ nf^1$. The number of microstates possible in an isolated gaseous state for this metal complex is :

(A) 14 (B) 6

(C) 20 (D) 84

20. If valence shell electron configuration of vanadium is $3d^3 4s^2$ and that of uranium is $5f^3 6d^1 7s^2$, then both $[vo_2]^+$ and $(uo_2)^{2+}$ will have :

(A) Same number of *d*-electrons and bent shape for both

(B) Same number of *d*-electrons with bent shape for $[vo_2]^+$ and linear shape for $[uo_2]^{2+}$

(C) Same number of *d*-electrons and linear shape for both

(D) Different oxidation states with linear shape for both

21. For the reaction with $[Cr(OH_2)_6]^{2+}$, the inner-sphere redox reaction proceeds the fastest for :

(A) $[Co(NH_3)_6]^{3+}$ (B) $[CoF(NH_3)_5]^{2+}$

(C) $[Co(NCS)(NH_3)_5]^{2+}$ (D) $[CoI(NH_3)_5]^{2+}$

22. The polypyrrole ring present in vitamin B_{12} is :

(A) Porphyrin (B) Chlorin

(C) Protoporphyrin (D) Corrin

23. The spin only magnetic moment of $[Co(NH_3)_6]Cl_3$ is :

(A) Zero B.M. (B) 4.90 B.M.

(C) 5.48 B.M. (D) 1.73 B.M.

24. Kurnakov test addition of thiourea (Th) to cis-Platin yields $[Pt(Th)_4]Cl_2$. In a similar process, trans-Platin will react with thiourea to yield : In

(A) Cis-Pt $(Th)_2Cl_2$

(B) Trans-Pt $(Th)_2Cl_2$

(C) Trans-$[Pt(NH_3)_2(Th)_2]Cl_2$

(D) Cis-$[Pt(NH_3)_2(Th)_2]Cl_2$

25. The t_{2g} orbital is filled and has a bonding character in an octahedral environment of :

(A) $[TiF_6]^{2-}$

(B) $[Co(NH_3)_6]^{3+}$

(C) $[Zn(en)_3]^{2+}$ (en = NH_2 . CH_2CH_2 NH_2)

(D) $Cr(CO)_6$

26. A radical containing two equivalent protons shows a three-line EPR spectrum with an intensity of 1 : 2 : 1. The spectral lines are observed at 3302 G, 3325 G and 3348 G. The hyperfine coupling constant of the proton is :

(A) 25 G

(B) 48 G

(C) 23 G

(D) 63 G

27. The metal ions that are commonly present at the active site of hydrolytic enzymes is :

(A) Zn^{2+}, Mg^{2+}, Ca^{2+}

(B) Zn^{2+}, Cu^{2+}, Co^{2+}

(C) Co^{2+}, Fe^{2+}, Mn^{2+}

(D) Mn^{2+}, Ni^{2+}, Mg^{2+}

28. The effective magnetic moment (μ_{eff}) of the $[Ti(H_2O)_6]^{2+}$ species is :

(A) 0

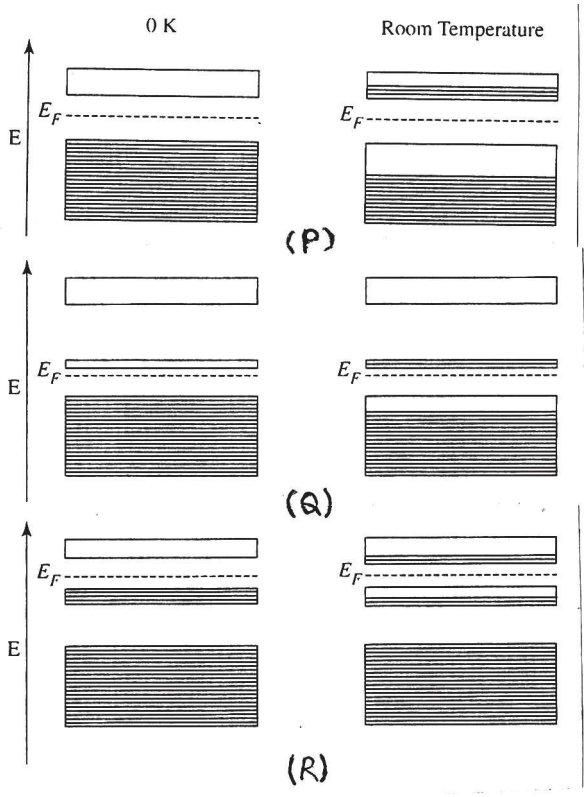
(B) 2.83 BM

(C) 3.42 BM

(D) 3.92 BM

29. Correct statement regarding the electronic transitions of *f*-block elements is :
    (A) *f-f* transition bands are broad
    (B) There is large *d-f* orbital mixing
    (C) The transitions are Laporte allowed
    (D) There is a little coupling of electronic transitions with molecular vibrations

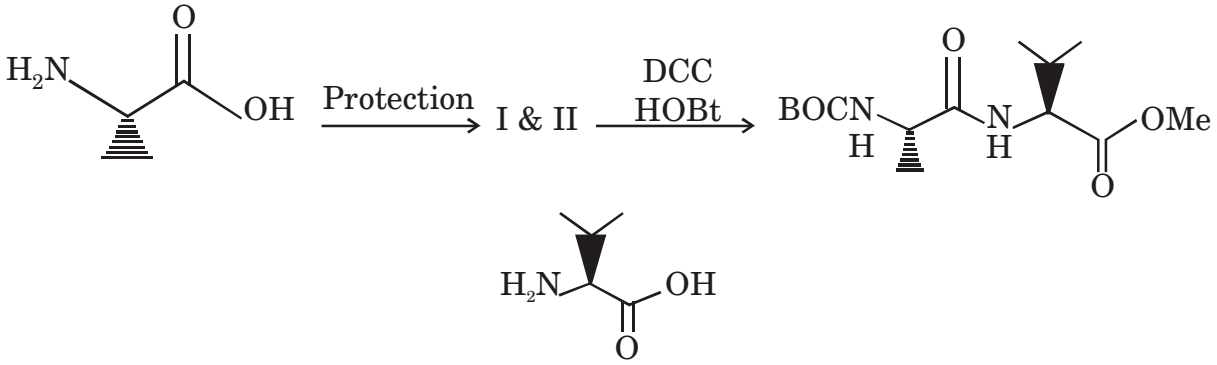
30. Semiconductors are class of crystalline solids that show electrical conductivity between conductors and insulators. The correct set of semiconductors from the pictorial representations Cat zero K and room temperature given below is :

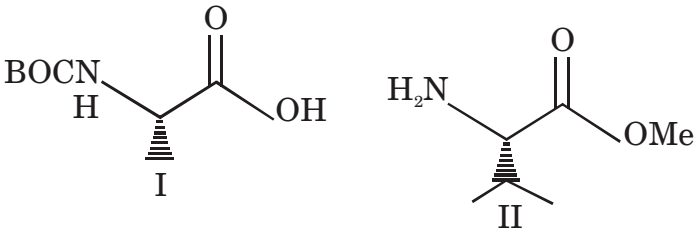


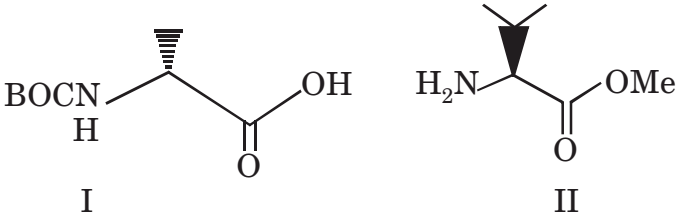
    (A) P = intrinsic semiconductor; Q = *p*-type semiconductor; R = *n*-type semiconductor
    (B) P = *p*-type semiconductor; Q = intrinsic semiconductor; R = *n*-type semiconductor
    (C) P = *n*-type semiconductor; Q = *p*-type semiconductor; R = intrinsic semiconductor
    (D) P = intrinsic semiconductor; Q = *n*-type semiconductor; R = *p*-type semiconductor

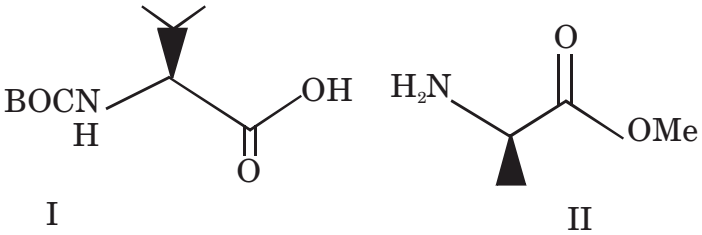
31. The number of signals exhibited by fluoroacetone in ^{1}H-NMR spectrum is :
    (A) Two doublets
    (B) Two singlets
    (C) One doublet and one singlet
    (D) One doublet and one triplet

32. Complete the following reaction by suggesting the appropriate substrates (I & II) :



(A)


(B)


(C)


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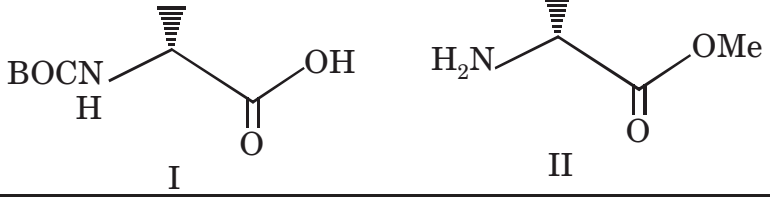
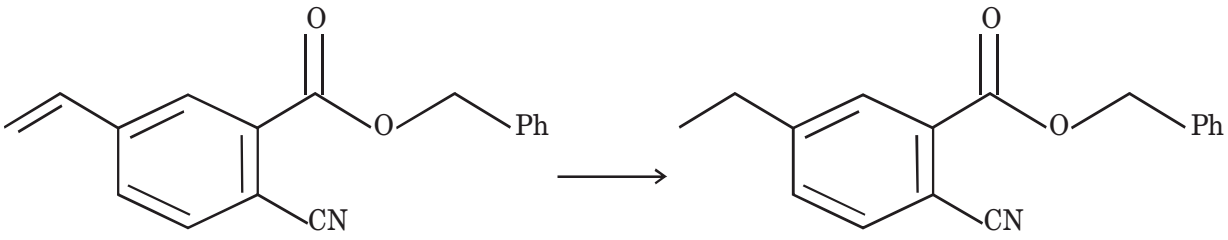


33. Suggest most suitable conditions for the following selective conversion :



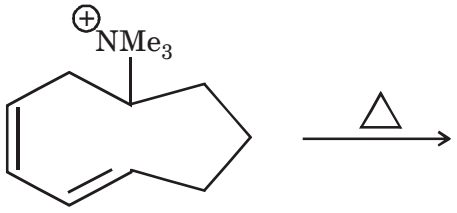
(A) H_2, Pd–C (Catalyst)

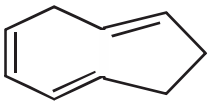
(B) H_2, RhCl $[PPh_3]_3$ (Catalyst)

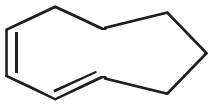
(C) H_2, PtO_2 (Catalyst)

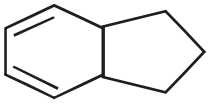
(D) H_2, Raney Ni

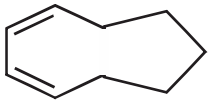
34. What major product is isolated from the following reaction :



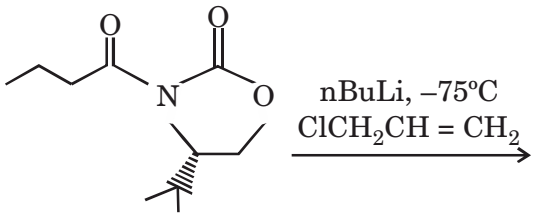
(A) 

(B) 

(C) 

(D) 

35. Predict stereochemical outcome of the following reaction :



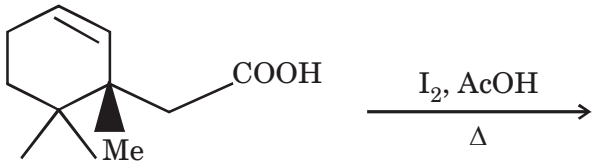
(A) The new stereogenic center formed will have 'S' configuration

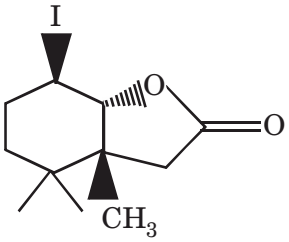
(B) The new stereogenic center formed will have 'R' configuration

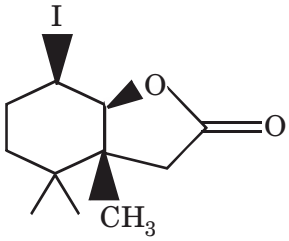
(C) Both the diastereomers formed are in equal amount

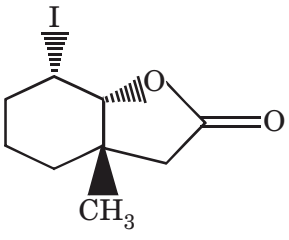
(D) The product formed will have no new chiral center

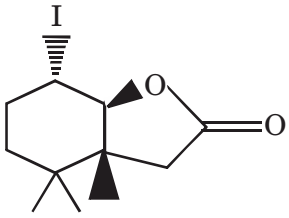
36. The major product of the following reaction is :



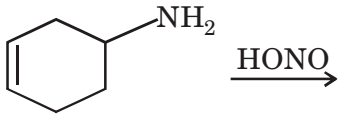
(A) 

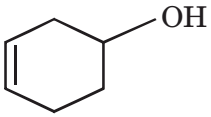
(B) 

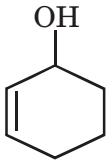
(C) 

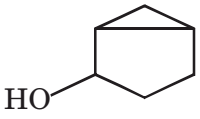
(D) 

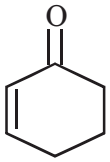
37. Predict the major product of the following reaction :



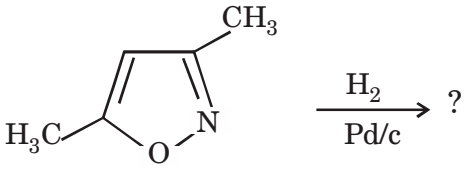
(A) 

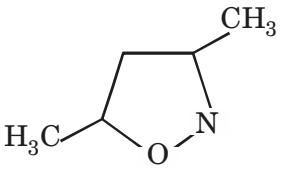
(B) 

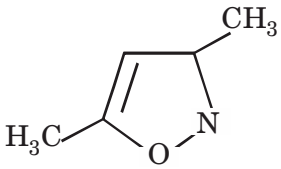
(C) 

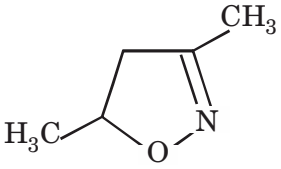
(D) 

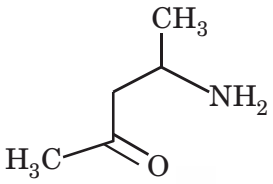
38. The major product of the following reaction is :



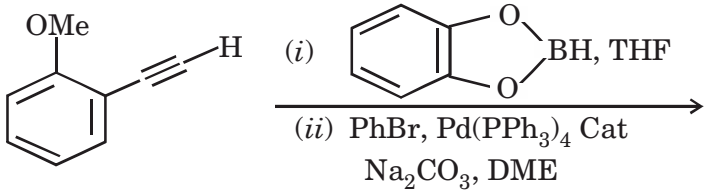
(A) 

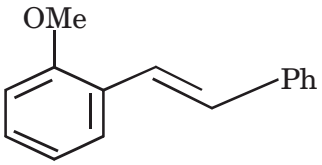
(B) 

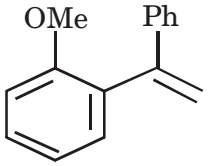
(C) 

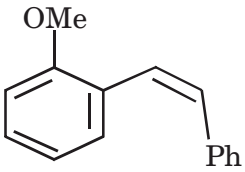
(D) 

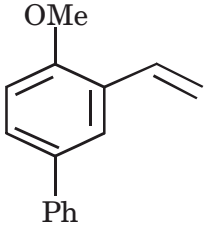
39. The major product of the following reaction is :



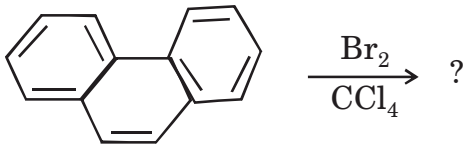
(A) 

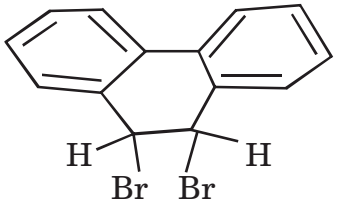
(B) 

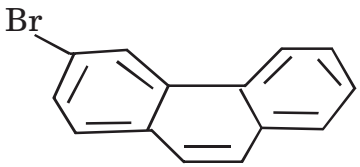
(C) 

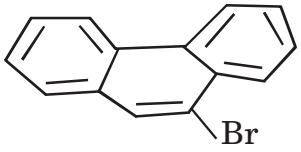
(D) 

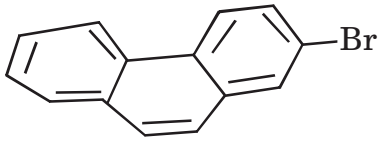
40. The major product formed in the following reaction is :



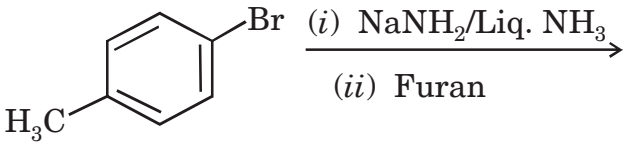
(A) 

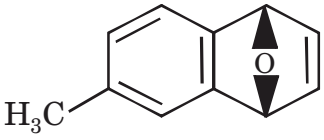
(B) 

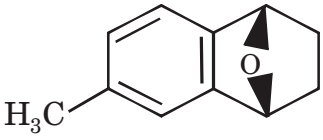
(C) 

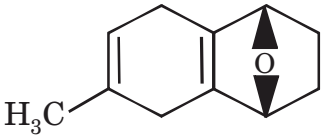
(D) 

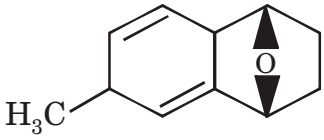
41. The major product formed in the following reaction is :



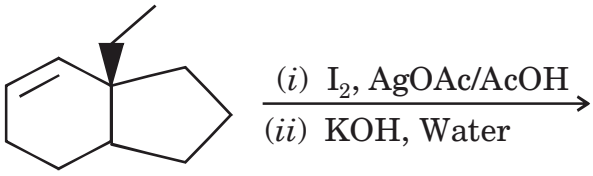
(A) 

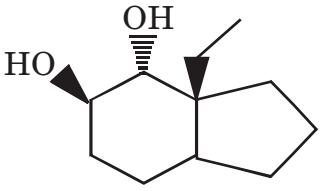
(B) 

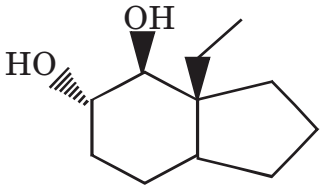
(C) 

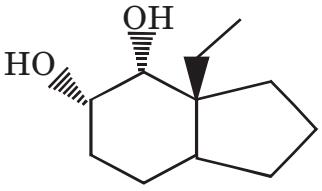
(D) 

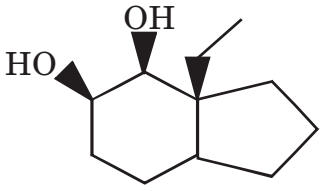
42. The major product of the following reaction is :



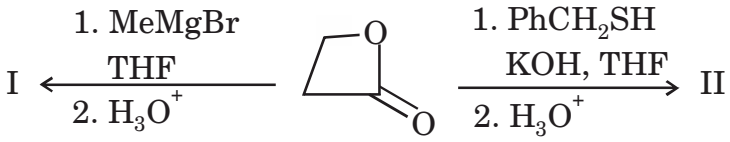
(A) 

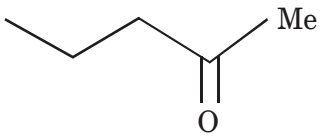
(B) 

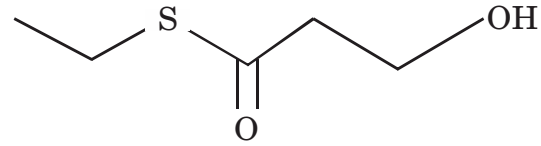
(C) 

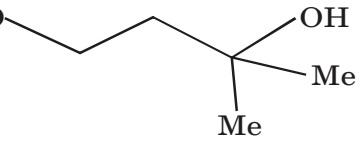
(D) 

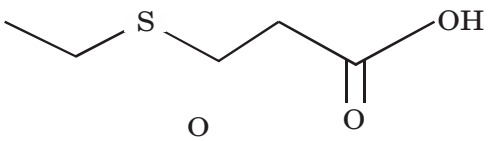
43. Predict the major product of the following reactions based on HSAB principle :

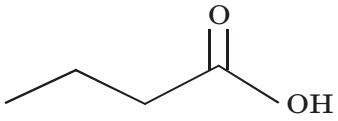


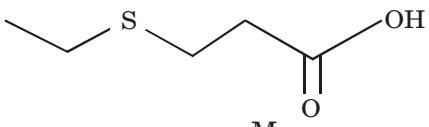
(A) I = 

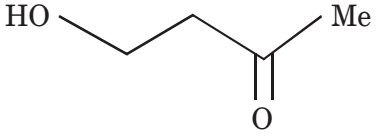
II = 

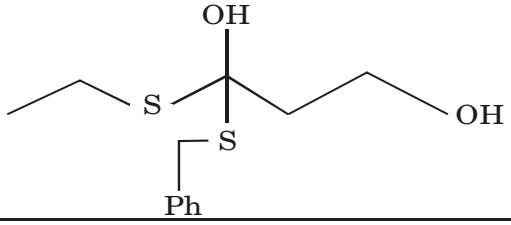
(B) I = 

II = 

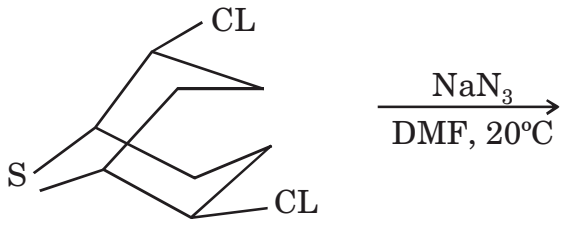
(C) I = 

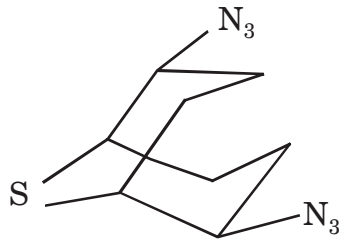
II = 

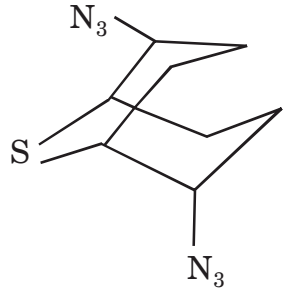
(D) I = 

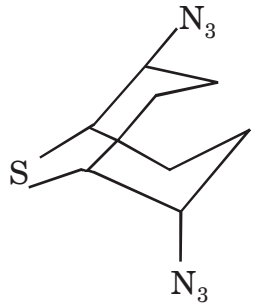
II = 

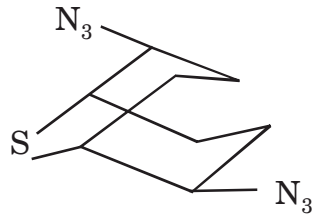
44. Predict the major product of the following reaction :



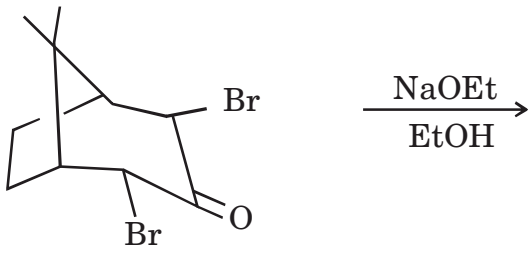
(A) 

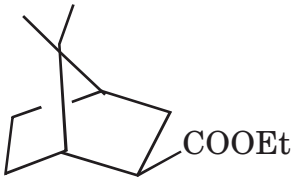
(B) 

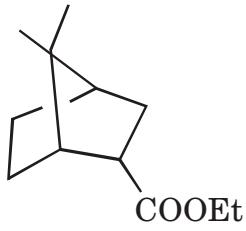
(C) 

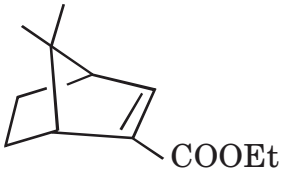
(D) 

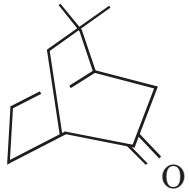
45. The structure of major product in the following reaction is :



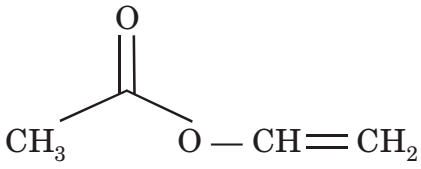
(A) 

(B) 

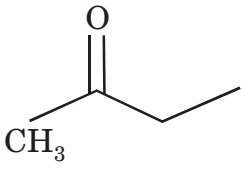
(C) 

(D) 

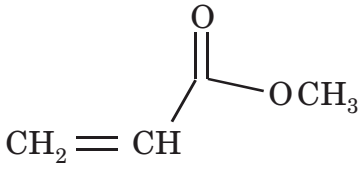
46. The correct order for stretching frequency of carbonyl group of the following molecules is :



I



II



III

(A) II > I > III

(B) I > II > III

(C) III > I > II

(D) I > III > II

47. The 19F-NMR spectrum of CF_2Br — CBr_2CN at – 98°C shows :

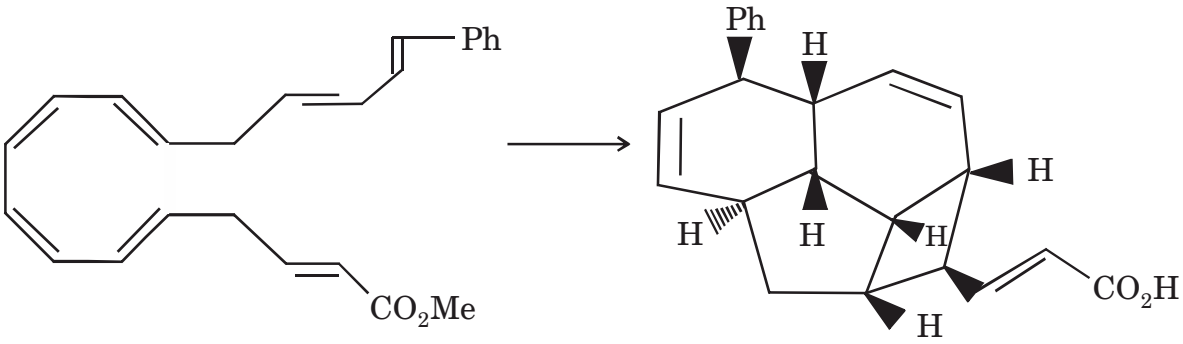
(A) Two doublets

(B) Two singlets

(C) Two doublets and a singlet

(D) Two singlets and one doublet

48. The correct sequence of pericyclic reactions to achieve the given multistep conversion is :



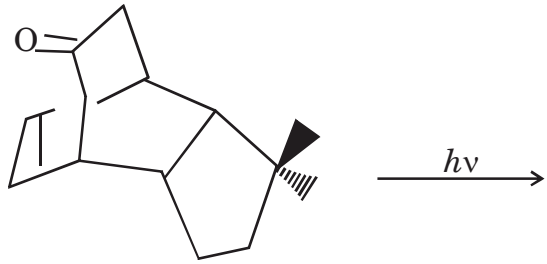
(A) (*i*) Disrotatory $8\pi e^-$ electrocyclization, (*ii*) conrotatory $6\pi e^-$ electrocyclization, (*iii*) Intramolecular $\pi 4s + \pi 2s$ cycloaddition.

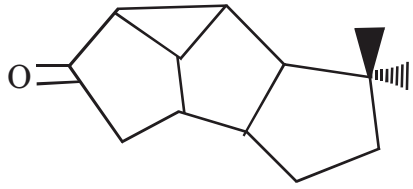
(B) (*i*) Conrotatory $8\pi e$ electrocyclization, (*ii*) disrotatory $6\pi e$ electrocyclization, (*iii*) Intramolecular $\pi 4s + \pi 2s$ cycloaddition.

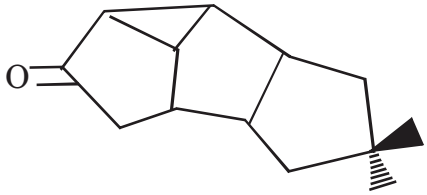
(C) (*i*) Disrotatory $8\pi e$ electrocyclization, (*ii*) Intramolecular $\pi 4s + \pi 2s$ cycloaddition, (*iii*) Conrotatory $6\pi \bar{e}$ electrocyclization

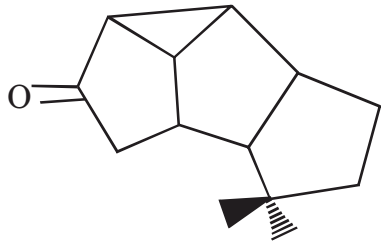
(D) (*i*) Conrotatory $8\pi e$ electrocyclization, (*ii*) Intramolecular $\pi 4s + \pi 2s$ cycloaddition, (*iii*) Disrotatory $6\pi e$ electrocyclization

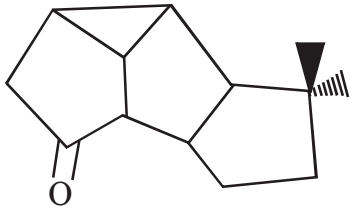
49. The major product of the following reaction is :



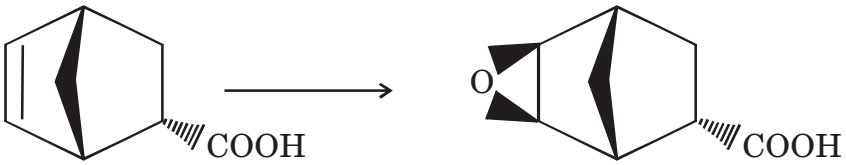
(A) 

(B) 

(C) 

(D) 

50. Suggest most appropriate reagent/conditions for the following conversion :



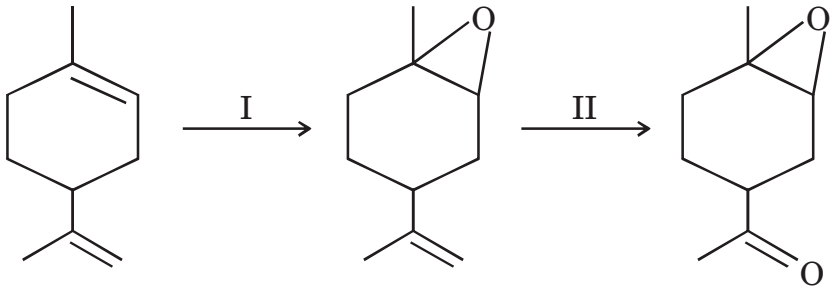
(A) *m*-CPBA; CH_2Cl_2

(B) DMDO; CH_2Cl_2

(C) CF_3COOOH; ACOH

(D) H_2O_2; NaOH

51. Predict the reagents for the following transformation :



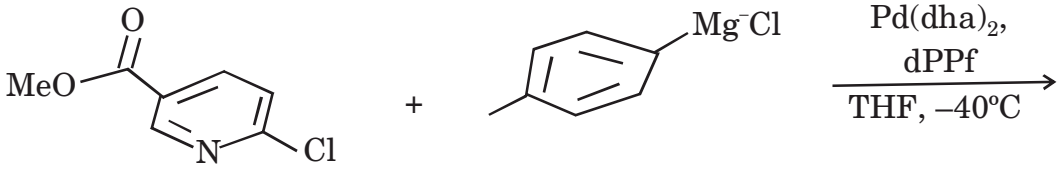
(A) I = DMDO, II = H_2O_2

(B) I = H_2O_2, II = *m*CPBA

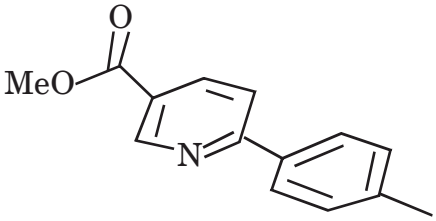
(C) I = H_2O_2, II = MnO_2

(D) I = mCPBA, II = O_3

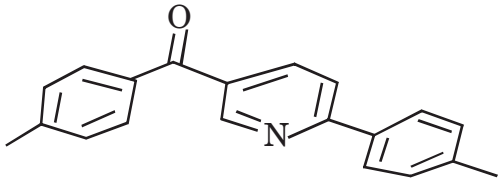
52. Predict the major product of the following reaction :



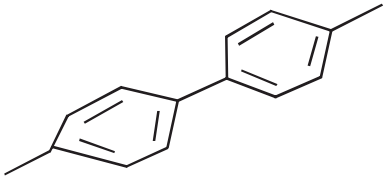
(A)



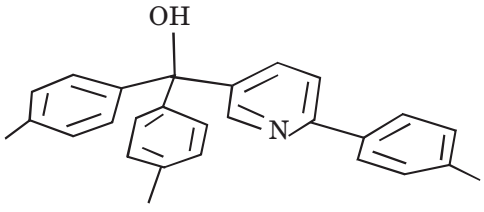
(B)



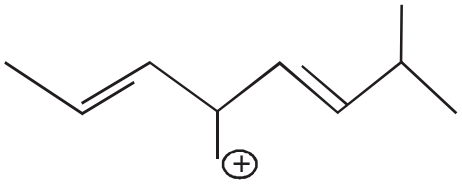
(C)

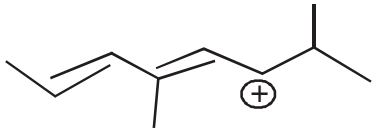


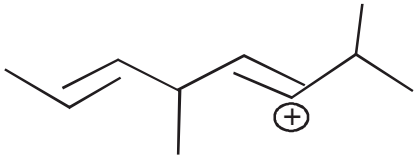
(D)

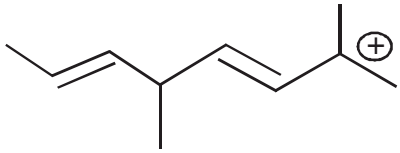


53. Which one of the following carbocations is the most stable ?

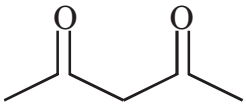
(A) 

(B) 

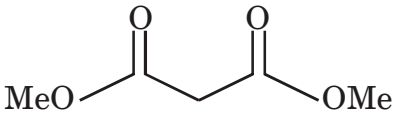
(C) 

(D) 

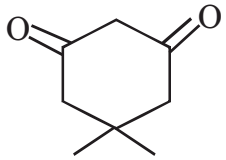
54. The correct order of the acidity between pairs of compounds given below is :



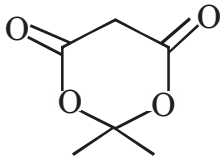
P



Q



R



S

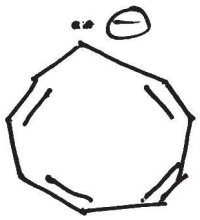
(A) Q > P and R > S

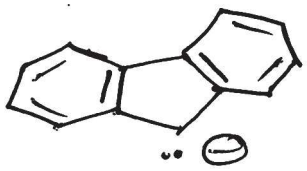
(B) P > Q and R > S

(C) P > Q and S > R

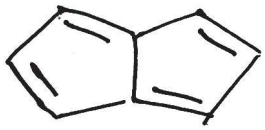
(D) Q > P and S > R

55. Predict which one of the following compounds is antiaromatic ?

(A) 

(B) 

(C) 

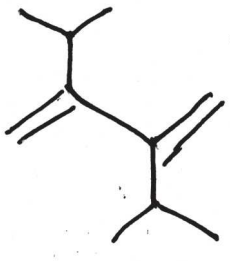
(D) 

56. Which of the following dienes is least suitable for Diels-Alder reaction with maleic anhydride ?

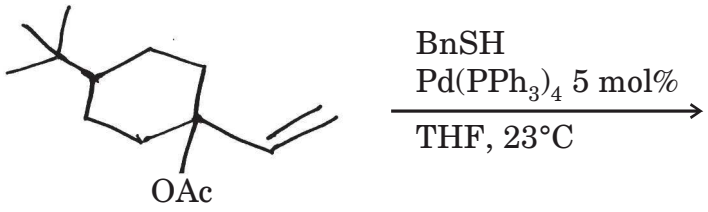
(A) 

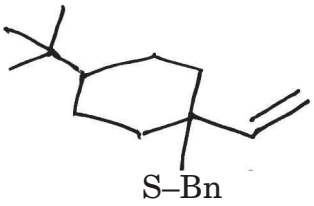
(B) 

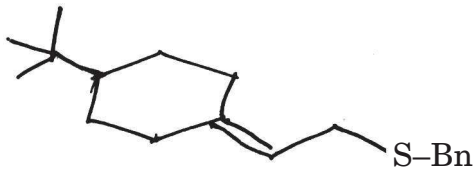
(C) 

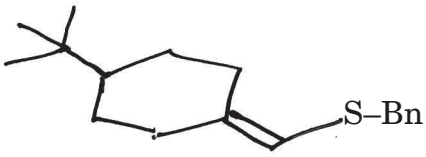
(D) 

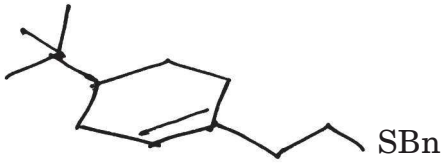
57. Predict the major product of the following reaction :



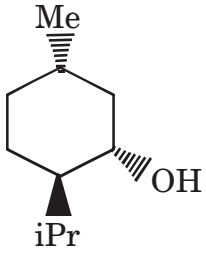
(A) 

(B) 

(C) 

(D) 

58. In a stable conformer of the following compound :



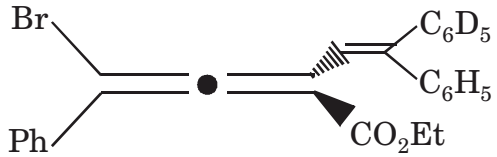
(A) Equatorial – iPr, $-CH_3$, –OH groups

(B) Equatorial – iPr and $-CH_3$ groups; Axial –OH group

(C) Equatorial – iPr group; axial $-CH_3$ and –OH groups

(D) Equatorial –iPr and – OH groups; axial – CH_3 group

59. Assign the chiral descriptors for the following molecule :



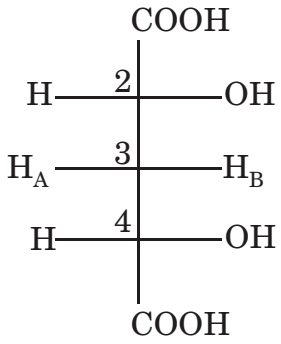
(A) S, E

(B) R, E

(C) S, Z

(D) R, Z

60. Absolute configuration of the chiral centres (C–2, C–4) and prochirality descriptors (H_A and H_B) in the following compound is :



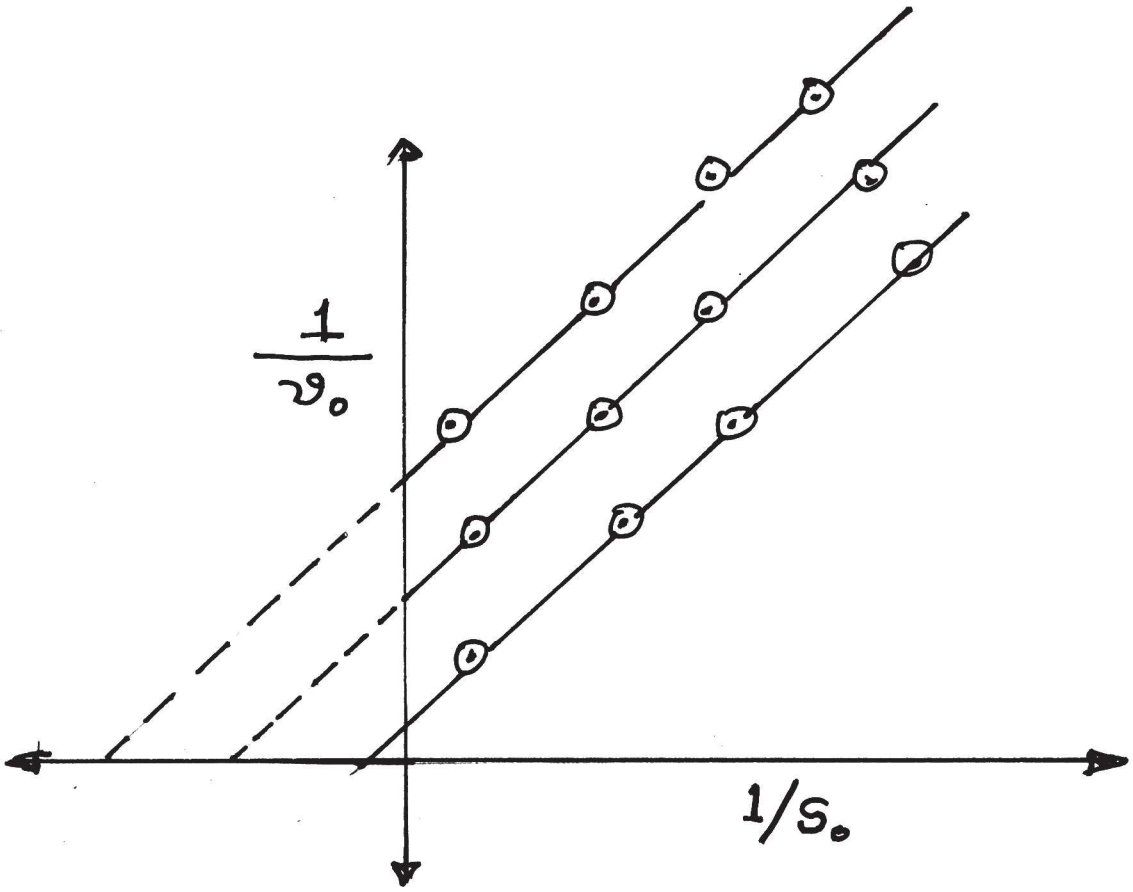
(A) 2R, 4S; H_A : Pro-s; H_B : Pro-r

(B) 2R, 4R; H_A : Pro-s; H_B : Pro-r

(C) 2S, 4S; H_A : Pro-r; H_B : Pro-s

(D) 2S, 4R; H_A : Pro-s; H_B : Pro-r

61. In the enzymolysis, the following graph represent Lineweaver-Burk plots for :



(A) Uncompetative inhibition

(B) Competative inhibition

(C) Non-competative inhibition

(D) Without any inhibition

62. For the first order consecutive reaction :

$$A \xrightarrow{K_1} B \xrightarrow{K_2} C$$

Which of the following statement is *incorrect* ?

(A) [A] decreases exponential with time

(B) [C] increases with inverse exponential function with time

(C) [B] is always greater than [C]

(D) The t_{max} depends on K_1 and K_2

63. A given reaction is fitted into the following Arrhenius form :

$$K_2 = 6.0 \times 10^{14}\ (S^{-1}).\ \exp\left[-\frac{104.4\,(k\text{J.mol}^{-1})}{RT}\right]$$

Value of the rate constant at very high temperature would be :

(A) $3.0 \times 10^4\ S^{-1}$

(B) $5.8 \times 10^{14}\ S^{-1}$

(C) $18.0 \times 10^{10}\ S^{-1}$

(D) $9.0 \times 10^4\ S^{-1}$

64. Enzymolysis with the following mechanism :

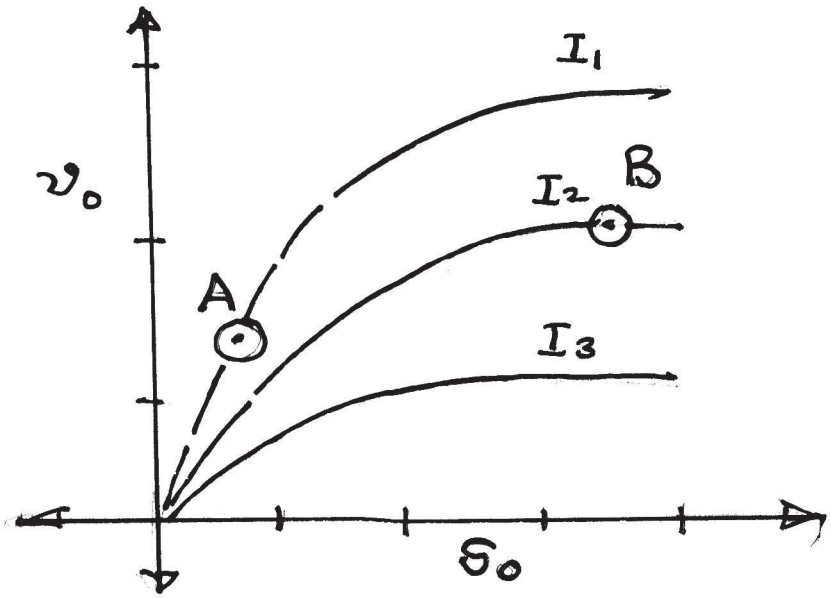
$$E + S \underset{k-1}{\overset{k_1}{\rightleftarrows}} ES$$

$$ES \xrightarrow{k_2} E + P$$

$$E + I \rightleftharpoons EI$$

$\because$ (I $\equiv$ inhibitor) $I_1 < I_2 < I_3$

The following behaviors are noted :



Orders of the reaction, at point 'A' and point 'B' marked on the graph would be :

(A) One and two

(B) Two and zero

(C) Zero and one

(D) One and zero

65. The following half cell represents, normal hydrogen electrode (NHE) :

(A) $Pt|H^+ (a = 1)|H_2(g)$ (1 atm)

(B) $Pt|H^+$ (1M H_2SO_4)$|H_2(g)$ (1 atm)

(C) $Pt|H^+$ (1M HCl)$|H_2(g)$ (1 atm)

(D) $Pt|H^+$ (1M H_3PO_4)$|H_2(g)$ (1 atm))

66. If, we discharge the electrochemical cell rapidly, then :

(A) Maximum enthalpy is converted to useful work

(B) Small amount of entropy is generated

(C) Cell is expected to deliver maximum energy density

(D) The cell will give out maximum entropy

67. E^o value for various ions are as follows :

$$E^o(MnO_4^-) = +1.51 \text{ V}$$

$$E^\circ(Ag/Ag^+) = +0.7996 \text{ V}$$

$$E^o(Au/Au^+) = +1.692 \text{ V}$$

$$E^o(Zn/Zn^{2+}) = -0.761 \text{ V}$$

Based on this data, permaganate can be used to oxidize :

(A) Au, Ag, Zn (B) Au, Ag

(C) Zn, Ag (D) Zn, Au

68. The position and momentum operators do not commute because :

(A) $\overset{n}{x}P_x\Psi = x * \frac{\hbar}{i}\frac{d\Psi}{dx}$ and $P_x \overset{n}{x}\Psi = \frac{\hbar}{i}\left(\Psi + x\frac{d\Psi}{dx}\right)$

(B) $\overset{n}{x}P_x\Psi = \frac{\hbar}{i}\left(\Psi + x\frac{d\Psi}{dx}\right)$ and $P_x \overset{n}{x}\Psi = \frac{x\hbar}{i}\frac{d\Psi}{dx}$

(C) $\overset{n}{x}P_x\Psi = P_x\, x\Psi = \frac{x\hbar}{i}\frac{d\Psi}{dx}$

(D) $\overset{n}{x}P_x\Psi = \frac{\hbar}{i}\frac{d\Psi}{dx}$

69. A ratio of relative probability of finding an electron in hydrogen atom in the volume region 1.0 pm^3 at $r = a_0$ w.r.t. the probability $r = 0$ (nucleus) is :

(A) 5.1 (B) 6.0

(C) 7.1 (D) 1.0

70. For the particle in 1-D box, the value of quantum number $n = 0$ is ruled out because :

(A) The energy of the particle becomes diverging at $n = 0$

(B) The wave function becomes divergent at $n = 0$

(C) Particle starts following classical mechanics principle

(D) It implies $\Psi = 0$, everywhere in the box

71. A crystal is spatial periodic arrangement of large number of atom/ions. When size of crystal is reduced to nano-meter range the diffraction peaks :

(A) Sharpen
(B) Broaden
(C) No change in HWFM
(D) Splits

72. Vapour pressure of 0.5 molal solution of non-volatile solute in organic solvent at 30ºC would be :

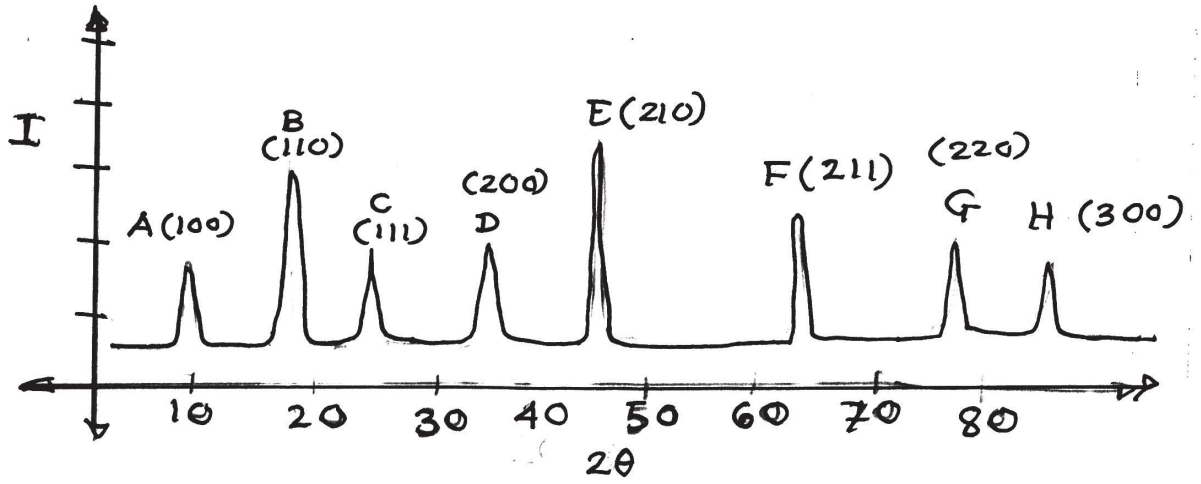
(Given : vapour pressure of pure organic solvent is 100 torr; the molecular weight of organic solvent is 100 g mol^{-1}).

(A) 125.50 torr
(B) 90.25 torr
(C) 100.25 torr
(D) 119.95 torr

73. Molar conductance of 0.01 M acetic acid was found to be 16×10^{-4} S m^2 mol^{-1} at 30ºC. Molar conductance of H^+ and CH_3COO^- ions at infinite dilution are 350×10^{-4} S m^2 mol^{-1} and 50×10^{-4} S m^2 mol^{-1}, respectively at same temperature. What percentage of acetic acid is dissociated at that concentration ?

(A) 0.040
(B) 0.055
(C) 0.072
(D) 0.080

74. The following XRD is recorded for the crystalline solid, having simple cubic crystal structure :



If this crystal would have been FCC, the following peaks would have missing :

(A) A, B, C, F, G H

(B) B D, F H A

(C) A B E F H

(D) F G H C D

75. The variation of C_p with pressure at constant temperature is given by :

(A) $-T\left(\frac{\partial^2 V}{\partial T^2}\right)_P$

(B) $T\left(\frac{\partial^2 S}{\partial T^2}\right)_P$

(C) $T\left(\frac{\partial S}{\partial T}\right)_P$

(D) $T\left(\frac{\partial^2 P}{\partial T^2}\right)_V$

76. Consider the reaction :

$$H_2S_{(g)} + \frac{3}{2} O_{2(g)} \rightleftharpoons SO_{2(g)} + H_2O_{(g)}, \Delta H^o = 518.62 \text{ kJ}$$

What is the effect of increase of temperature and pressure on the reaction ?

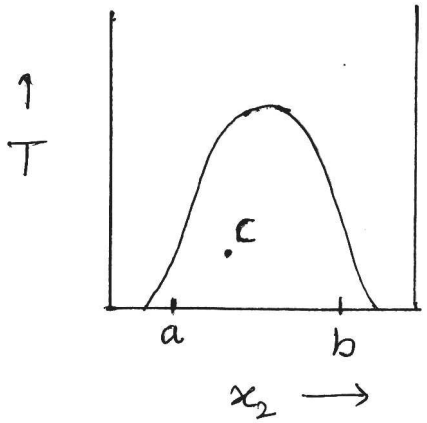
(A) Retardation and advancement of reaction, respectively

(B) Retardation of reaction in both cases

(C) Advancement of reaction in both cases

(D) No effect of increase in pressure and retardation due to increased temperature

77. According to the phase diagram given below, the composition of the layer '*a*' relative to the layer '*b*' at point '*c*' is :



(A) $\frac{ac}{bc}$

(B) $\frac{bc}{ac}$

(C) $\frac{ac}{ab}$

(D) $\frac{bc}{ab}$

78. The number of microstates of distributing five quanta of energy among four distinguishable particles is :

(A) 56 (B) 14

(C) 35 (D) 126

79. In terms of partition function, the free energy is given by :

(A) $-NkT \ln q + PV$

(B) $-NkT \ln q$

(C) $-NkT \frac{d}{dt} \ln q$

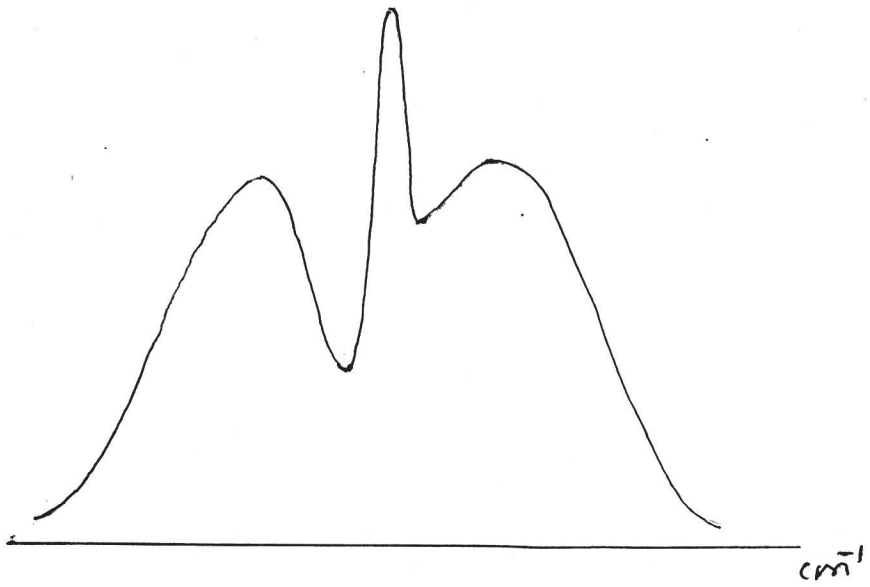
(D) $NkT^2 \ln q + PV$

80. The pH of the mixture of 800 ml of 0.1 M HCl and 200 ml of 0.3 M NaOH is close to :

(A) 1.10 (B) 6.90

(C) 13.3 (D) 1.70

81. The spectra shown below is due to :



(A) Perpendicular vibrations in a linear polyatomic molecule

(B) Vibrational-rotational transitions in a diatomic molecule

(C) Effect of nuclear spin homonuclear diatomic molecule

(D) Breakdown of Born-Oppenheimer approximation

82. For a molecule to be Raman active :

(A) Dipole moment of molecule must change during molecular transitions

(B) It must have polarizability

(C) Molecular motion must cause some change in molecular polarizability

(D) It must have non-zero dipole moment

83. 'Provided the moment of inertia of a diatomic molecule is 1.40×10^{-46} kg. m^2, what can be stated about the population in first excited rotational level at 25°C ?

(Given : $kT = 4.1 \times 10^{-21}$ J)

(A) All the molecules are in ground energy level

(B) All the molecules are in excited energy level

(C) Equal population in ground and excited level

(D) Slightly high population in ground level compared to excited level

84. A compound shows a peak at 240 Hz down field relative to reference peak on NMR instrument working at 60 MHz. What is the chemical shift (τ) of the compound ?

(A) 6 ppm (B) 7 ppm

(C) 3 ppm (D) 4 ppm

85. For a free radical containing two equivalent protons, lines occur at 330.2 mT, 332.5 mT and 334.8 mT. What is the hyperline coupling constant for each proton ?

(A) 4.6 mT (B) 2.3 mT

(C) 2.3 T (D) –4.6 mT

86. In which state Be^{3+} will have same orbital radius as that of ground state of hydrogen atom ?

(A) $n = 1$ (B) $n = 0$

(C) $n = 2$ (D) $n = 3$

87. The term representing electron-nucleus interaction in Hamiltonian operator for many electron atom is proportional to :

(A) $\sum_i \frac{e^2}{r_{ij}}$ (B) $-\sum_i \frac{Ze^2}{r_i}$

(C) $\sum_i \frac{Ze}{r_i}$ (D) $-\frac{Ze^2}{r_{ij}}$

88. The secular determinant for a heteronuclear diatomic molecule is :

(A) $(\alpha_A - E)(\alpha_B - E) - \beta^2 = 0$

(B) $(\alpha - E)^2 - (\beta - ES)^2 = 0$

(C) $(\alpha - E)^2 - \beta^2 = 0$

(D) $(\alpha_A - E)(\alpha_B - E) - (\beta - ES)^2 = 0$

89. The significance of weight average ($\overline{M}w$) and number average ($\overline{M}n$) molecular weights is that :

(A) $\overline{M}w$ is sensitive to low molecular weight species

(B) $\overline{M}n$ is sensitive to high molecular weight species

(C) $\overline{M}w$ is sensitive to high molecular weight and $\overline{M}n$ is sensitive to low molecular weight

(D) $\overline{M}n / \overline{M}w$ gives information of polydispersivity

90. If the fraction of surface sites occupied by an adsorbate is given by $\frac{V}{V_m}$, the equation for adsorption isotherm is :

(A) $\frac{1}{V_m} = \frac{1}{PbV_m} + \frac{1}{V}$

(B) $\frac{V}{V_m} = \frac{1}{V_m} + \frac{1}{Pb}$

(C) $\frac{1}{V} = \frac{1}{PbV_m} + \frac{1}{V_m}$

(D) $\frac{V}{V_m} = 1 + \frac{1}{PbV}$

91. Sharp absorbance in case of silver and gold nanoparticles observed in UV-vis spectroscopy is attributed to :

(A) Lattice phonon vibrations

(B) Oscillation of free electrons on metal surface

(C) Size quantization effect

(D) Interaction among nanoparticles

92. Major source of post-industrial CO_2 emission other than vehicular emission is/ are from :

(A) Paper industry
(B) Textile industry
(C) Cement and steel industry
(D) Pharmaceutical industry

93. For a butadiene molecule, the energy values of levels obtained by using HMO theory are :

(1) $\alpha - 1.6\ \beta$

(2) $\alpha + 1.6\ \beta$

(3) $\alpha + 0.6\ \beta$

(4) $\alpha - 0.6\ \beta$

What is the sequence of levels in the order of increasing energy ?

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

94. The total multiplicity of the R-S term $^5I_4$ is :

(A) 65
(B) 13
(C) 9
(D) 18

95. $[NO_2]^+$ has a shape similar to :

(A) SO_2
(B) SiO_2
(C) H_2O
(D) O_3

96. The number of significant figures to the answer of subtraction (64.6312 – 64.5899) is :

(A) 4 (B) 6

(C) 3 (D) 2

97. Hyperfine lines expected in the EPR spectrum of tetranuclear rhodium $\left(I = \frac{1}{2}\right)$ complex :

(A) 5 (B) 2

(C) 4 (D) 3

98. Catalytic converters are used for reduction and oxidation reactions to reduce harmful emissions. The reduction of nitrogen oxides uses the following metal based catalyst :

(A) Pt; Rh (B) Ni; Pt

(C) Fe; Pd (D) Co; Ni

99. Ketoconazole is commonly used as :

(A) Antibacterial (B) Antitubercular

(C) Antifungal (D) Antimalarial

100. Which of the following molecule is a prodrug ?

(A) Vancomycin (B) Aspirin

(C) Amphotericin B (D) Pencillin G

ROUGH WORK

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