Test Booklet Code & Serial No.
प्रश्नपत्रिका कोड व क्रमांक

B

Paper-III
CHEMICAL SCIENCE

Seat No. | | | | | | |

(In figures as in Admit Card)

Seat No. .....

(In words)

OMR Sheet No. | | | | | | |

(To be filled by the Candidate)

Signature and Name of Invigilator

1. (Signature) .....

(Name) .....

2. (Signature) .....

(Name) .....

APR - 33317

Time Allowed : 2½ Hours] **[Maximum Marks : 150**

Number of Pages in this Booklet : **32**

Number of Questions in this Booklet : **75**

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 **75** objective type questions. Each question will carry *two* marks. *All* questions of Paper-III will be compulsory, covering entire syllabus (including all electives, without options).
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 (C) is the correct response.

   (A) (B) ● (D)

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. परिक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात लिहावा. तसेच आपणांस दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
2. सदर प्रश्नपत्रिकेत **75** बहुपर्यायी प्रश्न आहेत. प्रत्येक प्रश्नास **दोन** गुण आहेत. या प्रश्नपत्रिकेतील **सर्व** प्रश्न सोडविणे अनिवार्य आहे. सदरचे प्रश्न हे या विषयाच्या संपूर्ण अभ्यासक्रमावर आधारित आहेत.
3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनीटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात.
   (*i*) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्विकारू नये.
   (*ii*) **पहिल्या पृष्ठावर नमूद केल्याप्रमाणे प्रश्नपत्रिकेची एकूण पृष्ठे तसेच प्रश्नपत्रिकेतील एकूण प्रश्नांची संख्या पडताळून पहावी. पृष्ठे कमी असलेली/कमी प्रश्न असलेली/प्रश्नांचा चूकीचा 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 पहिल्यानंतरच 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 (C) हे योग्य उत्तर असेल तर.

   (A) (B) ● (D)

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

Chemical Science
Paper III

Time Allowed : 75 Minutes] **[Maximum Marks : 150**

Note : This Paper contains **seventy five (75)** multiple choice questions, each question carrying **Two (2)** marks. Attempt *All* questions.

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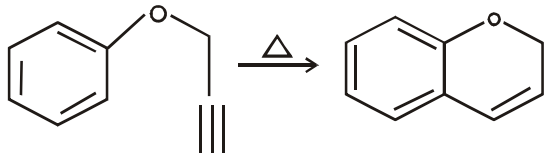
1. Which of the following Actinide oxide is as strong oxidizing agent as $KMnO_4$?
   (A) UO_2^{2+} (B) NpO_2^{2+}
   (C) PuO_2^{2+} (D) AmO_2^{2+}
2. Cis and trans $[PtA_2X_2]$ type of complexes are distinguished by interacting with :
   (A) Chromyl chloride (B) Thiourea
   (C) Potassium dichromate (D) Iron sulphate heptahydrate
3. In the lattice of *r*-Fe_2O_3, Fe^{3+} cations occupy.....octahedral sites.
   (A) 13 (B) $13^{1/2}$
   (C) $13^{1/3}$ (D) $13^{1/4}$
4. A hexagonal close packed (hcp) structure wherein all the octahedral voids are occupied is represented by :
   (A) NiAs (B) α–Al_2O_3
   (C) CdI_2 (D) CsCl
5. The noble gas which does *not* form clathrate compound is :
   (A) Ne (B) Ar
   (C) Kr (D) Xe
6. The *correct* sequence of steps involved in the formation of the product in the following reaction is :



   (A) [3.3]-sigmatropic shift; [1.5]-H shift; electrocyclic ring closure
   (B) Cope rearrangement; electrocyclic ring closure; [1.5]-H shift
   (C) Claisen rearrangement; electrocyclic ring closure; [1.5]-H shift
   (D) [1.3]-H shift; electrocyclic ring closure; Claisen rearrangement

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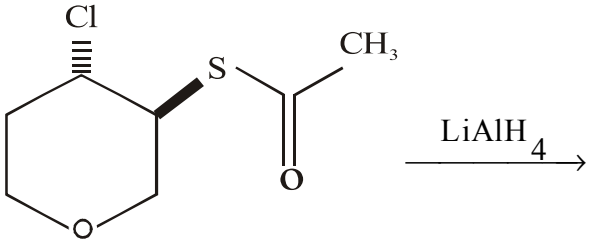
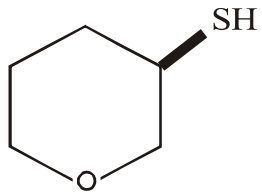
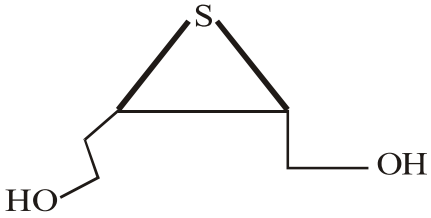
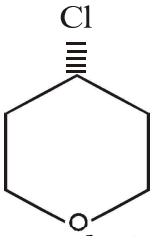
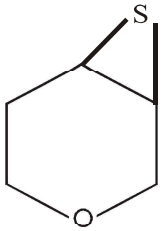
7. The major product formed in the following reaction is :



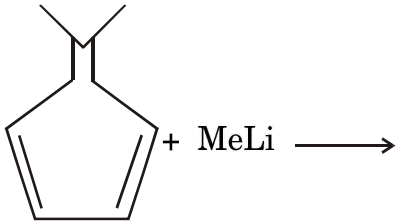
(A) 

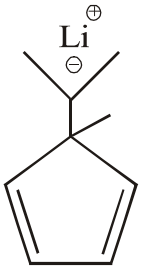
(B) 

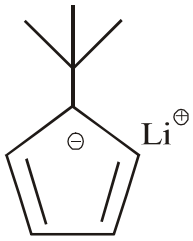
(C) 

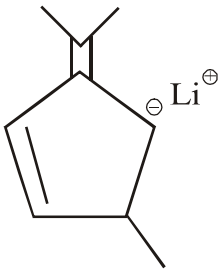
(D) 

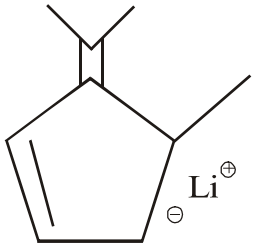
8. Major product formed in the following reaction is :



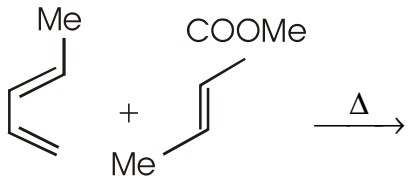
(A) 

(B) 

(C) 

(D) 

9. Major product formed in the following reaction is :



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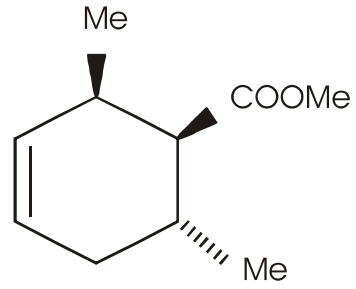

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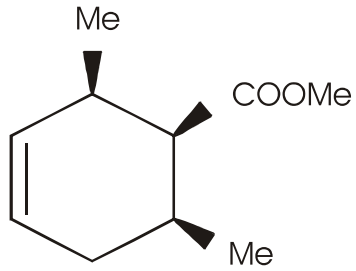

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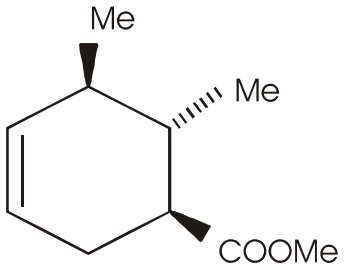

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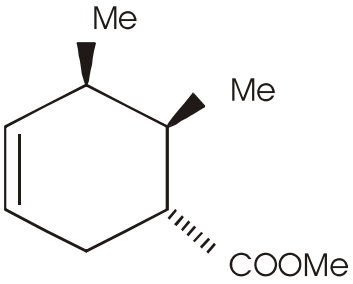
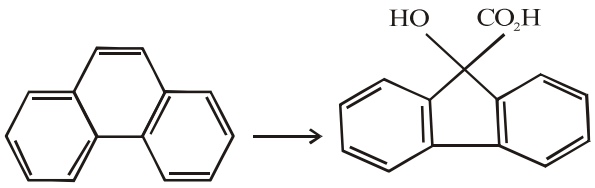


10. The *correct* reagents to affect the following conversion is :



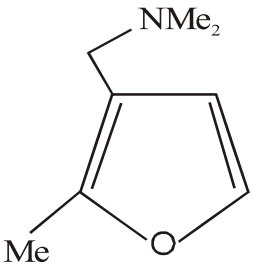
(A) (*i*) O_3, H_2O_2, (*ii*) $NaIO_3$

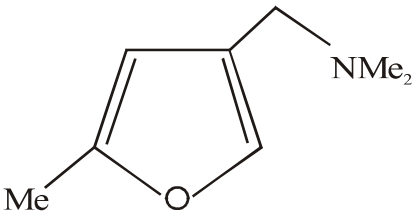
(B) (*i*) CrO_3, glacial AcOH (*ii*) NaOH

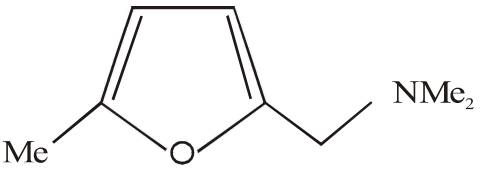
(C) (*i*) CrO_3, glacial AcOH (*ii*) H_2SO_4

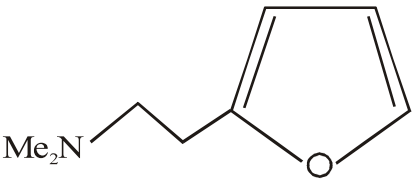
(D) (*i*) $KMnO_4$, Na_2CO_3 (*ii*) $Pb(OAc)_4$, AcOH

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

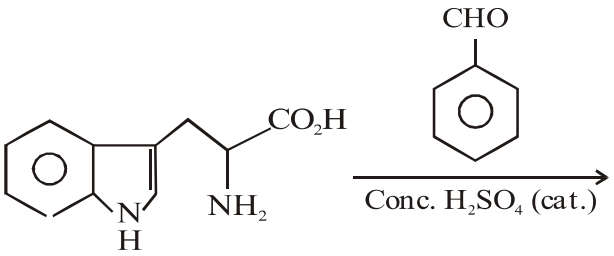
(A) 

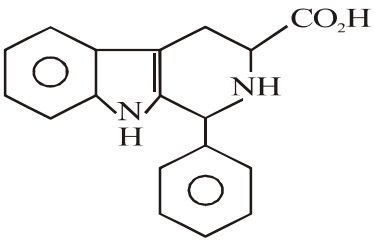
(B) 

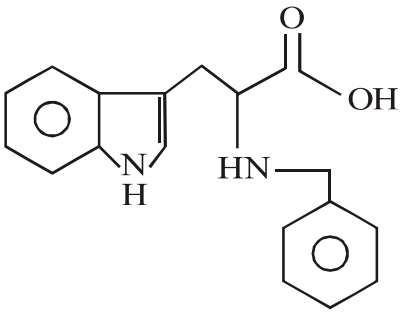
(C) 

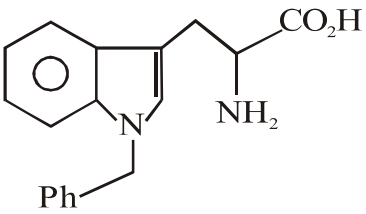
(D) 

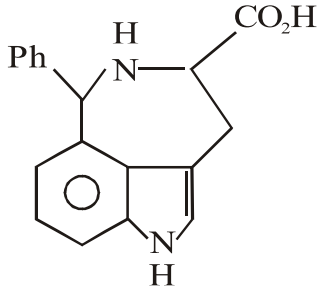
12. Major product formed in the following reaction is :

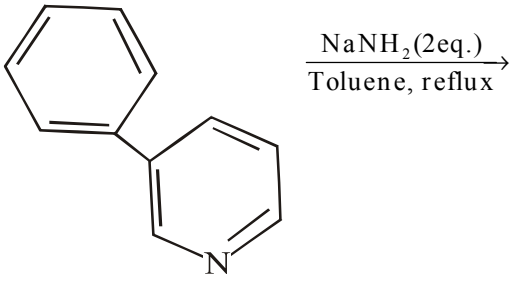


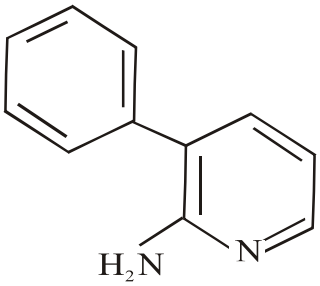
(A) 

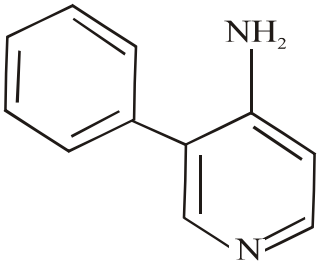
(B) 

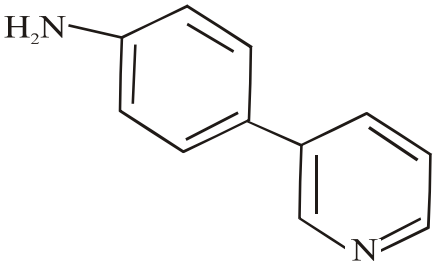
(C) 

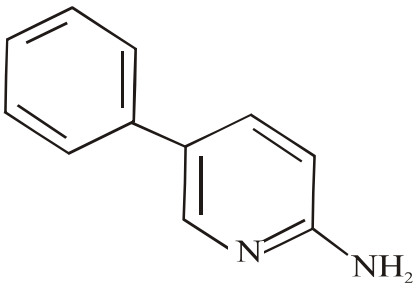
(D) 

13. 

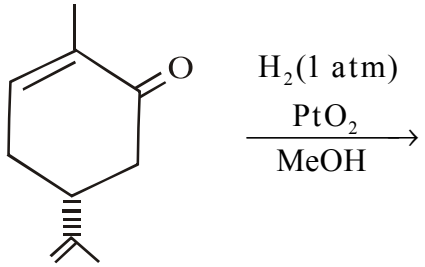
(A) 

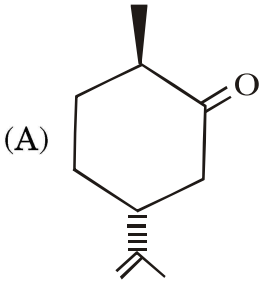
(B) 

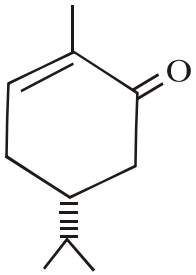
(C) 

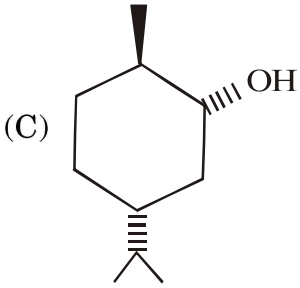
(D) 

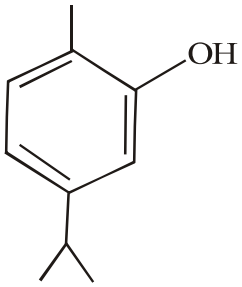
14. Major product formed in the following reaction is :



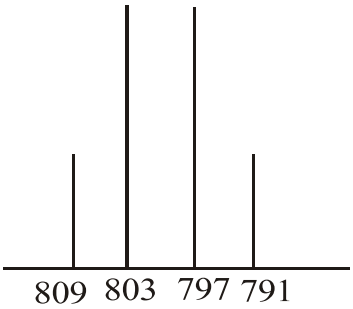
(A) 

(B) 

(C) 

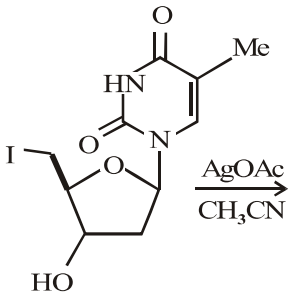
(D) 

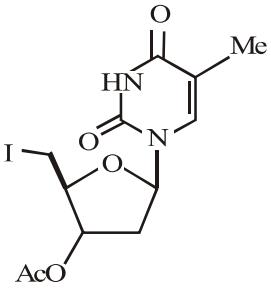
15. A signal shows the following line positions in 200 MHz NMR instrument. The chemical shift in δ and coupling constant in Hz respectively are :

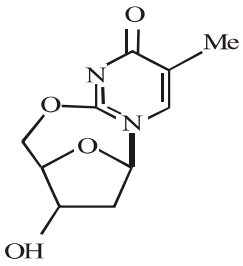


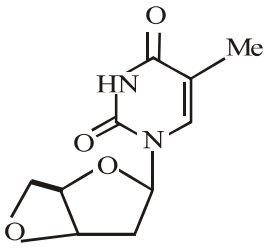
(A) δ4.0, J = 6 Hz
(B) δ4.3, J = 9 Hz
(C) δ4.0, J = 3 Hz
(D) δ4.3, J = 6 Hz

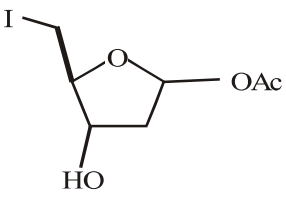
16. Major product formed in the following reaction is :



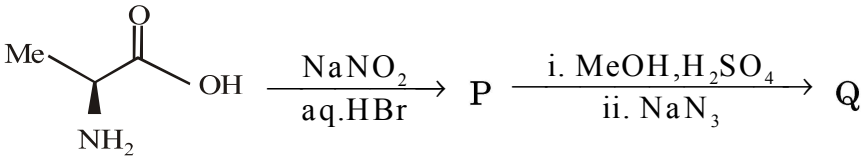
(A) 

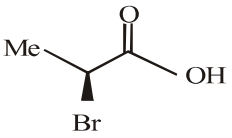
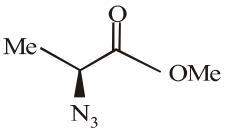
(B) 

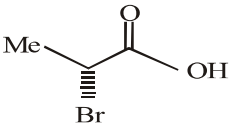
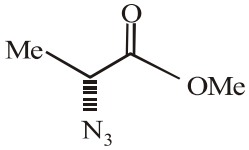
(C) 

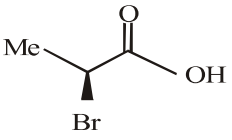
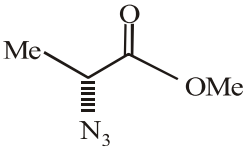
(D) 

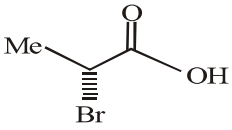
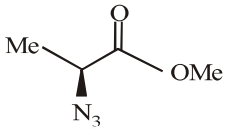
17. Major products P and Q formed in the following reaction sequence are :



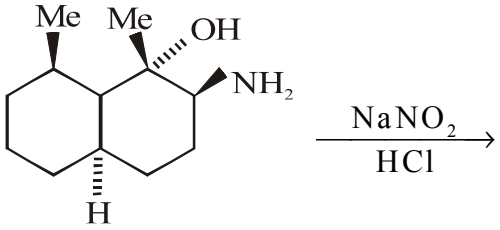
(A) P =  Q = 

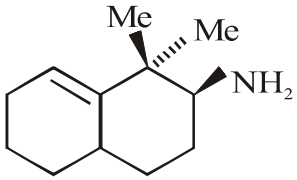
(B) P =  Q = 

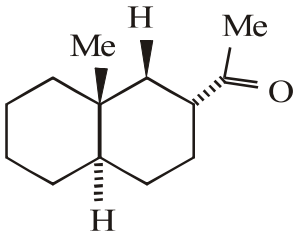
(C) P =  Q = 

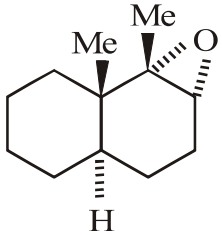
(D) P =  Q = 

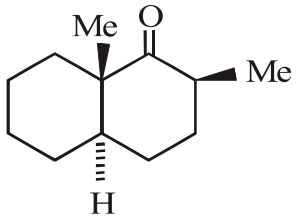
18. Major product formed in the following reaction is :



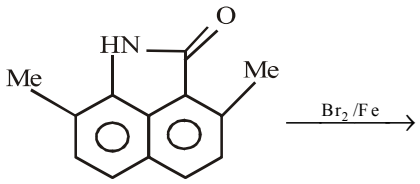
(A) 

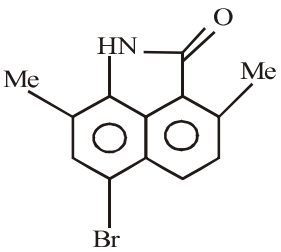
(B) 

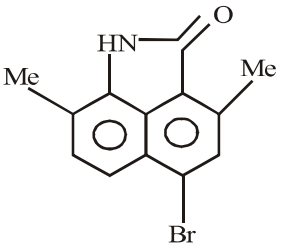
(C) 

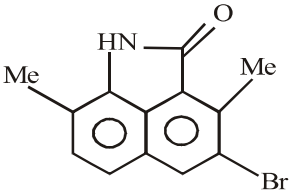
(D) 

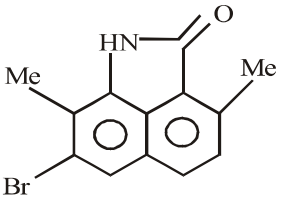
19. The major product formed in the following reaction is :



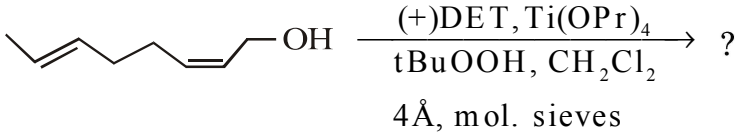
(A) 

(B) 

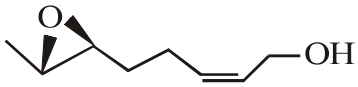
(C) 

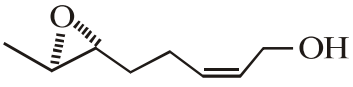
(D) 

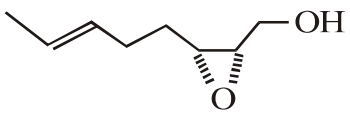
20. The major product formed in the following reaction is :



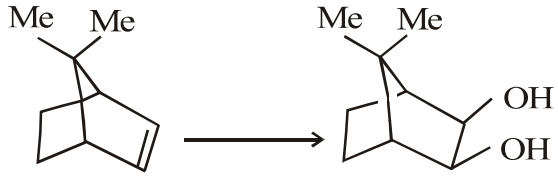
(A)

(B) 

(C) 

(D) 

21. The *correct* reagents combination to effect the following conversion is :



(A) $KMnO_4$, *t*–Bu–OH–H_2O, Na_2 CO_3

(B) OsO_4, NMO, acetone

(C) (*i*) *m*–CPBA, $CHCl_3$ (*ii*) $H_3O^{\oplus}$

(D) (*i*) I_2, AgOAc, AcOH, H_2O (*ii*) NaOH (aq.)

22. The *correct* structure of the compound that exhibits the following ^1H–NMR spectrum is :

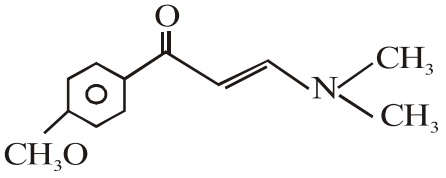
δ 3.0 (*s*, 6H); 3.9 (s, 3H);

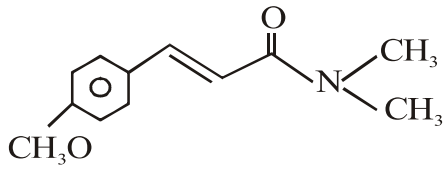
5.8 (*d*, J = 12.3 Hz, 1H);

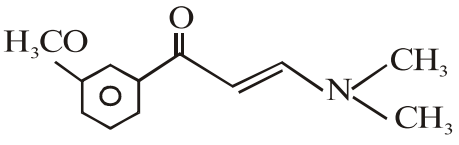
6.85 (*d*, J = 8.0 Hz, 2H);

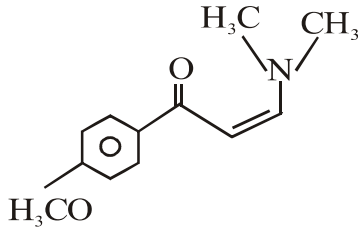
7.8 (*d*, J = 8.0 Hz, 2H);

8.0 (*d*, J = 12.3 Hz, 1H).

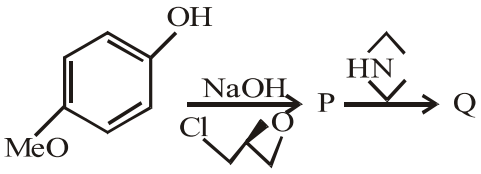
(A) 

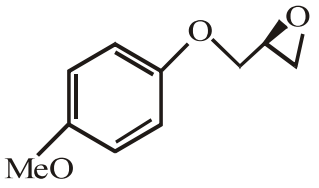
(B) 

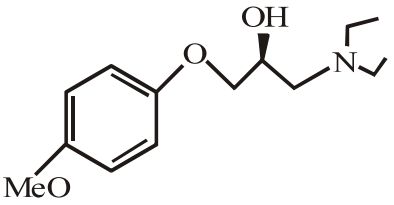
(C) 

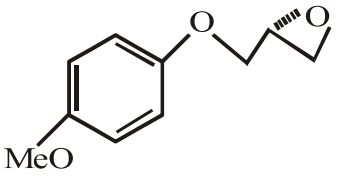
(D) 

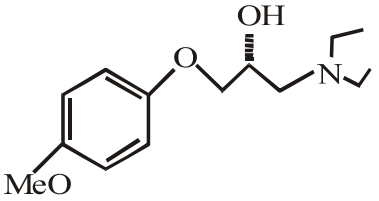
23. The major products P and Q formed in the following reactions are :

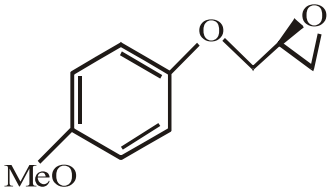


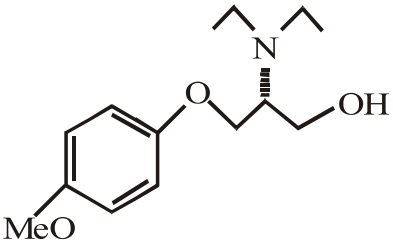
(A) P = 

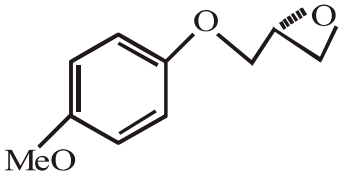
Q = 

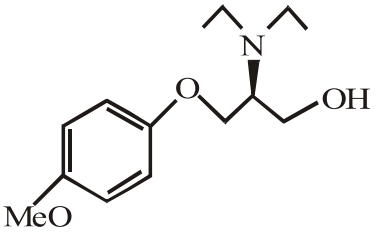
(B) P = 

Q = 

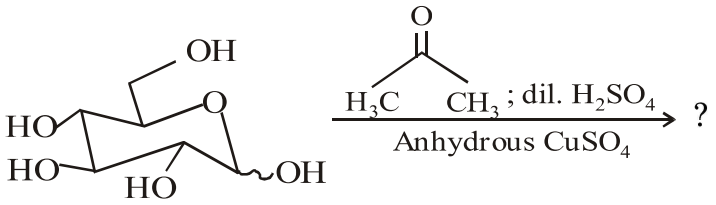
(C) P = 

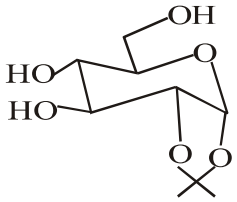
Q = 

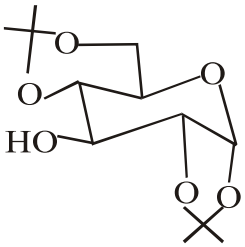
(D) P = 

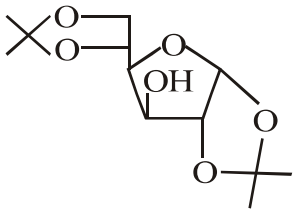
Q = 

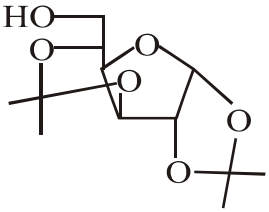
24. The major product formed in the following reaction is :



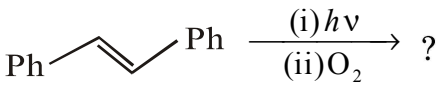
(A) 

(B) 

(C) 

(D) 

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



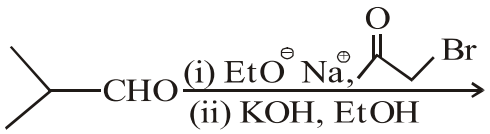
(A) Phenanthrene

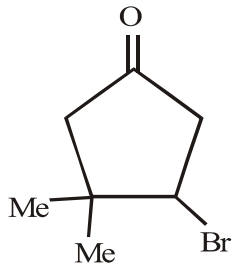
(B) Anthracene

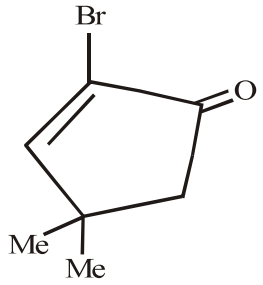
(C) Pyrene

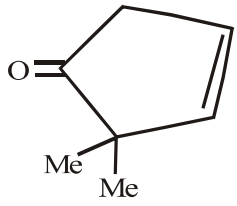
(D) Phenanthroline

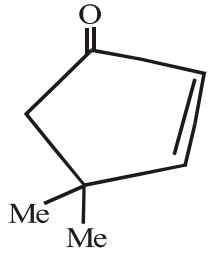
26. Major product formed in the following reaction sequence is :



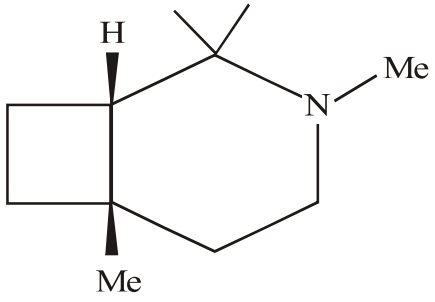
(A) 

(B) 

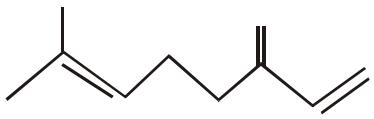
(C) 

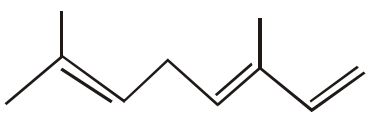
(D) 

27. Major product formed in the following reaction is :

(A) 

(B)

(C) 

(D) 

28. The *correct* match of natural product in Column-I with class in Column-II is :

Column I	**Column II**
(P) Camphor	(*i*) Terpene
(Q) Ascorbic acid	(*ii*) Protein
(R) α-Keratine	(*iii*) Enzyme
	(*iv*) Vitamin

(A) (P) – (*i*); (Q) – (*iv*); (R) – (*ii*)

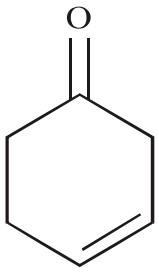
(B) (P) – (*i*); (Q) – (*ii*); (R) – (*iii*)

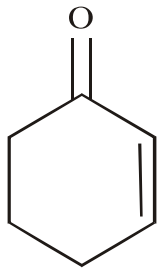
(C) (P) – (*iv*); (Q) – (*i*); (R) – (*ii*)

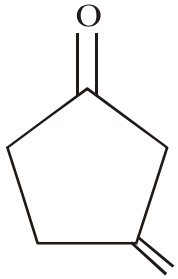
(D) (P) – (*iii*); (Q) – (*iv*); (R) – (*i*)

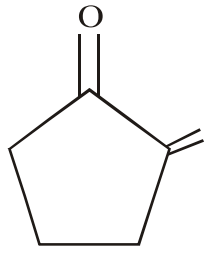
29. The *correct* structure of compound that exhibits the following ^{1}H-NMR spectrum is :

δ 6.6 (dt, J = 10 and 7 Hz, 1H); 6.0 (d, J = 10 Hz, 1H); 3.2 (t, J = 6.5 Hz, 2H); 2.0 (m, 2H), 1.6 (m, 2H)

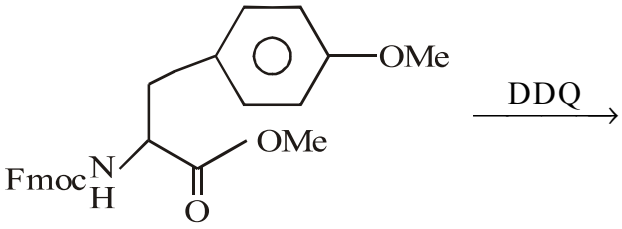
(A) 

(B) 

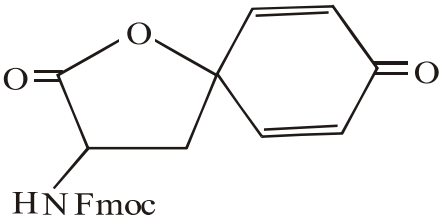
(C) 

(D) 

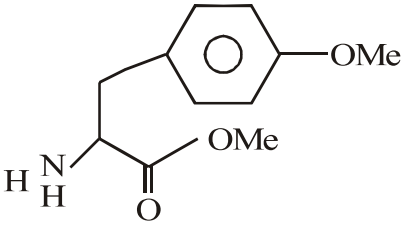
30. The major product formed in the following reaction is :



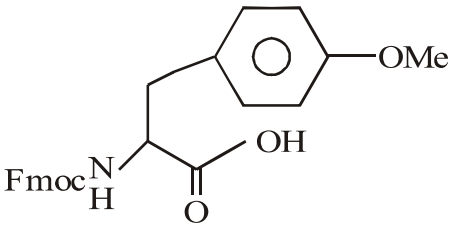
(A)



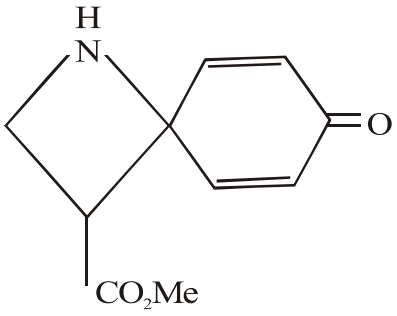
(B)



(C)



(D)



31. For an observable A, the relation $\langle A \rangle_{ensemble} = \langle A \rangle_{time}$ is known as :

(A) Euler's theorem

(B) Caratheodary's principle

(C) Ergodic hypothesis

(D) Average energy theorem

32. Conservation of mass in open system is given by :

(A) $dm = d_i m$

(B) $dm = d_e m$

(C) $d_e m = d_i m$

(D) $d_e m = 0$

33. Using Onsager's reciprocity theory, an electroosmotic flow is defined :

(A) $\left(\frac{J}{I}\right)_{\Delta T=0} = \frac{L_{21}}{L_{11}}$

(B) $\left(\frac{I}{J}\right)_{\Delta T=0} = \frac{L_{21}}{L_{11}}$

(C) $\left(\frac{I}{J}\right)_{\Delta P=0} = \frac{L_{21}}{L_{11}}$

(D) $\left(\frac{J}{I}\right)_{\Delta P=0} = \frac{L_{21}}{L_{11}}$

34. Entropy production for chemical reactions is given by :

(A) $d_i S = \frac{A d\xi}{T} > 0$

(B) $d_i S = \frac{A d\xi}{T} < 0$

(C) $d_i S = -\frac{A d\xi}{T} > 0$

(D) $d_i S = -\frac{A d\xi}{T} < 0$

35. The statement that "in the neighbourhood of any given state of a thermodynamic system, there exist states that cannot be reached from it by any quasi-static adiabatic process" is known as :

(A) Euler's theorem

(B) Legendre principle

(C) Ensemble dynamics

(D) Caratheodory principle

36. To every observable in classical mechanics there exists a corresponding linear ..... in quantum mechanics.

(A) Hamiltonian operator
(B) Probability function
(C) Hermitian operator
(D) Non-commutator

37. Which of the following statements is *not* true for quantum mechanical harmonic oscillator ?

(A) The smaller the mass of the oscillating particle, the greater will be its zero-point energy, for a fixed force constant.

(B) The frequency is the same as that of a classical oscillator with the same mass and force constant.

(C) Increasing the force constant increases the spacing between adjacent energy levels.

(D) The vibrational potential energy is a constant of motion.

38. The spin multiplicity of an atom in its ground state and having the outer-shell configuration $4s^2 3d^7$ is :

(A) 19
(B) 15
(C) 7
(D) 4

39. Which of the following is a prediction that would result from a simple HMO treatment of the butadienyl cation, $C_4H_6^+$?

(A) The ESR coupling constant is larger for hydrogens attached to the two inner carbons.

(B) The central C-C bond has a higher π-bond order than it has in the neutral molecule.

(C) The positive charge resides mostly on the two central carbons.

(D) The MO coefficients on the central pair of carbons are larger in all of the π MOs than they are in the neutral molecule.

40. Destruction of Ozone in the stratosphere is taking place by the following mechanism

$$O_3 + M \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} O_2 + O + M$$

$$O_3 + O \xrightarrow{K_2} 2O_2$$

The rate of destruction will be :

(A) $\frac{d[O_3]}{dt} = -k_1[O_3][M] + k_1[O_2][O][M] - k_2[O_3][O]$

(B) $\frac{d[O_3]}{dt} = k_1[O_3][M] - k_{-1}[O_2][O][M] + k_2[O_3][O]$

(C) $\frac{d[O_3]}{dt} = -k_1[O_3][M] + k_1[O_2][M] - k_2[O_3][O]$

(D) $\frac{d[O_3]}{dt} = k_1[O_3][M] - k_1[O_2][M] + k_2[O_3][O]$

41. From the Collision Theory, bimolecular rate constant for the gaseous reaction is given as $k(T) = p\pi b_{max}^2 v_r \exp\left(-\frac{\varepsilon^*}{kT}\right)$. The steric factor p having value, normally ranging from 0.1-0.001 reflects :

(A) Fraction of successful collisions the reactants can have.

(B) Range of probabilities that reactants will be in the correct configuration for the reaction.

(C) Steric hindrance between colloiding reactants.

(D) Transition probability of electrons between the reactants

42. The following experimental data was obtained for the reaction $2A + B \rightarrow C + D$

$[A]_0$ /M	$[B]_0$ /M	Rate/M.s^{-1}
0.1	0.1	1.2×10^{-3}
0.1	0.2	1.2×10^{-3}
0.2	0.1	2.4×10^{-3}

Which of the following is/are *correct* ?

(*i*) $d[C]/dt = k[A]^2[B]$

(*ii*) $d[C]/dt = k[A]$

(*iii*) $-d[C]/dt = k[A]$

(*iv*) Unit of k is s^{-1}

(A) (*ii*) and (*iv*)

(B) (*iii*) and (*iv*)

(C) (*i*) only

(D) (*ii*) only

43. In the enzymolysis, initial rate levels off with increasing substrate concentration because :

(A) Too much of a substrate inhibits the reaction.

(B) At high substrate concentration, all the enzyme molecules get tied up with the substrates and thus not available for further binding.

(C) The substrate start reacting with the product at higher concentration.

(D) The steady state approximation fails at high substrate concentration.

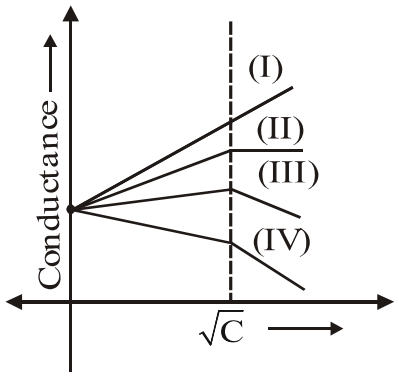
44. log $(\gamma\pm)$of 0.005 mol kg^{-1} KCl (aq.) at 25 C is :

Given : $\sqrt{0.005} = 0.0707$

(A) – 0.036 (B) – 0.005

(C) – 0.041 (D) – 0.020

45. A plot of conductance *Vs.* $\sqrt{C}$ for the typical ionic surfactant would ideally look like :



(A) (I) (B) (II)

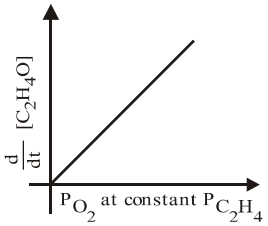
(C) (III) (D) (IV)

46. Oxidation of ethylene on Ag catalyst surface takes place by the following mechanism :

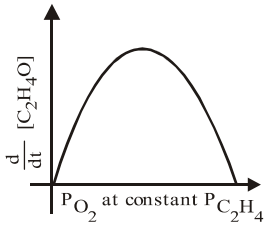
$$C_2H_4\ (g) + O_2\ (ads) \rightarrow C_2H_4O$$

Which of the following plots describes this process ?

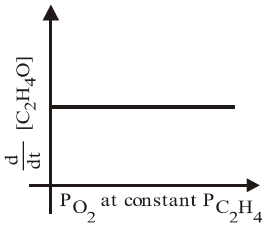
(A)



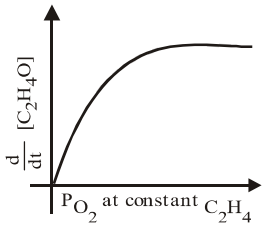
(B)



(C)



(D)



47. Which of the following statements is *true* for the given electrochemical cell ?

$$Ag \mid Ag^{+} \parallel NO_3^{-}, NO, Pt$$

(A) NO undergoes oxidation at the anode

(B) Pt acts as a catalyst

(C) The mass of the Ag electrode decreases

(D) The voltage of the cell is doubled when the size of the Ag electrode is doubled

48. Which of the following is *correct* about critical micelle concentration at a given temperature in water and 0.05M NaCl ?

(A) CMC of $C_{12}H_{25}SO_4Na$ in water and in 0.05M NaCl are the same

(B) CMC of $C_{12}H_{25}SO_4Na$ in water is lower than that in 0.05M NaCl

(C) CMC of $C_{12}H_{25}SO_4Na$ in NaCl is higher due to common ion effect

(D) CMC of $C_{12}H_{25}SO_4Na$ in NaCl is lower due to better counter ion binding

49. Which of the following is *correct* ?

(A) $AlCl_3$ is a Lewis acid catalyst

(B) Zeolites are good cayalysts for redox reactions

(C) MgO is a solid acid catalyst

(D) Zeolites are two-dimensional aluminosilicates

50. The boiling point of diethyl ether is $34.6^{\circ}C$. Which of the following is true with respect to dimethyl ether at $25^{\circ}C$ and 1 atm ?

(A) $\Delta G^0_{Vap} > 0$ (B) $\Delta H^0_{Vap} < 0$

(C) $K_{Vap} = 1.0$ (D) $\Delta S^0_{Vap} < 0$

51. Which of the following is/are acceptable quantum mechanical wave functions ?

(*i*) $f(X) = X^2 + 1$, for all values of X

(*ii*) $\Psi = 1/(4 - X); 0 \leq X \leq 10$

(*iii*) $\Psi = 1/(4 - X); 0 \leq X \leq 3$

(A) (*ii*) and (*iii*) (B) (*i*) only

(C) (*i*) and (*iii*) (D) (*iii*) only

52. According to simple collision theory of reaction rates, when the temperature is increased from 400K to 800K the number of collisions will :

(A) Increase 2 times

(B) Increase 1.414 times

(C) Remain the same

(D) Increase 4 times

53. The ionization energy for hydrogen atom is 13.6 eV. The ionization energy for the ground state of Li^{2+} is :

(A) 27.2 eV

(B) 6.8 eV

(C) 122.4 eV

(D) 40.8 eV

54. Which of the following is *not* a feature of Born Oppenheimer approximation ?

(A) Nuclear coordinates remain unchanged during electronic transitions

(B) Excited and ground electronic states have the same internuclear distance

(C) Electronic and vibrational motions are separable

(D) Amplitude of nuclear vibrations is smaller than that of electrons

55. An ensemble representing an open, isothermal system at constant temperature, volume and chemical potential is known as :

(A) grand-canonical ensemble

(B) canonical ensemble

(C) micro-canonical ensemble

(D) isothermal isobaric ensemble

56. In atomic spectroscopy, when a nebulized sample is carried into a flame, desolvation of the droplets occurs in the ..... zone.

(A) Inner zone

(B) Outer zone

(C) Primary combustion zone

(D) Secondary combustion zone

57. Which of the following statements is *true* for the selection of a developing solvent in paper chromatography ?

(A) The distribution ratios of the components in the solvent system should be dependent on concentration.

(B) The solvent should not undergo chemical reaction with any of the components of the sample mixture.

(C) The solvent should interfere with the detection of the spots on the developed chromatogram.

(D) The composition of the solvent system should alter with time.

58. Columns I and II represent thermal methods and their graphs :

I	II
(*a*) TG	(*e*) *dm*/*dt* *Vs.* Temperature
(*b*) DTG	(*f*) mass *Vs.* Temperature or time
(*c*) DTA	(*g*) *d*H/*dt* *Vs.* Temperature
(*d*) DSC	(*h*) ΔT *Vs.* Temperature

The *correct* match is :

(A) (*a*)-(*h*), (*b*)-(*g*), (*c*)-(*f*), (*d*)-(*e*)

(B) (*a*)-(*f*), (*b*)-(*e*), (*c*)-(*g*), (*d*)-(*h*)

(C) (*a*)-(*f*), (*b*)-(*e*), (*c*)-(*h*), (*d*)-(*g*)

(D) (*a*)-(*f*), (*b*)-(*h*), (*c*)-(*e*), (*d*)-(*g*)

59. Which statement about the trans effect and trans influence is *correct* ?

(A) The trans influence is a ground state effect, whereas the trans effect has a kinetic origin.

(B) The trans effect is a ground state effect, whereas the trans influence has a kinetic origin

(C) Both trans effect and trans influence are ground state effects.

(D) Rates of substitution are affected by the trans effect but not by trans influence

60. The *correct* order of Nephelauxetic parameter (β) for halides is :

(A) $Cl^- > Br^- > I^- > F^-$

(B) $I^- > Br^- > Cl^- > F^-$

(C) $Br^- > Cl^- \simeq I^- > F^-$

(D) $F^- > Cl^- > Br^- > I^-$

61. Jahn–Teller distortion in octahedral complexes is shown by :

(A) Low spin d^6, d^8 and d^9 complexes

(B) High spin d^4, low spin d^7 and d^9 complexes

(C) High spin d^5, low spin d^6 and d^9 complexes

(D) High spin d^3, high spin d^6 and d^9 complexes

62. The *correct* hapticity for cyclopenta diene in the following sixteen electron complex $[Ti\ (C_5H_5)_4]$ is :

(A) $[Ti\ (\eta^5\text{–}\ C_5H_5)_4]$

(B) $[Ti\ (\eta^5\text{–}\ C_5H_5)_2\ (\eta^1\text{–}\ C_5H_5)_2]$

(C) $[Ti\ (\eta^3\text{–}\ C_5H_5)_2\ (\eta^1\text{–}\ C_5H_5)_2]$

(D) $[Ti\ (\eta^3\text{–}\ C_5H_5)_4]$

63. The room temperature (26°C) magnetic moment per copper (II) ion in copper acetate monohydrate is 1.4 B.M. The magnetic behaviour can be best explained by (At. No. Cu = 29)

(A) Ferromagnetic coupling of two copper (II) spins.

(B) Antiferromagnetic coupling of two copper (II) spins.

(C) Ferrimagnetic coupling of two copper (II) spins.

(D) This is the normal magnetic behaviour of this compound.

64. The reversible coordination of oxygen between two metal atoms occurs in a bridging dihapto manner ($u - \eta^2\ \eta^2$) in :

(A) Oxyhemerythrin (B) Oxyhemocyanin

(C) Deoxyhemocyanin (D) Deoxyhemerythrin

65. $[Ni\ (en)_3]^{2+}$ has three absorption bands in electronic spectra : 11,200, 18350 and 2900 cm^{-1}. The 10 Dq value of the complex :

(A) 8,960 cm^{-1} (B) 13,440 cm^{-1}

(C) 18,350 cm^{-1} (D) 11,200 cm^{-1}

66. The strongest π acceptor ligand is :

(A) CN^- (B) PCl_3

(C) PF_3 (D) PMe_3

67. EPR spectrum of tris (2, 2^1 – bipyridine) titanium (III) ion, $[Ti\ (Dipy)_3]^{3+}$, (I = 5/2 for ^{47}Ti). When the electron couple with nuclear spin of Ti^{3+} will show ..... lines (At. No. Ti = 22).

(A) 6 (B) 18

(C) 5 (D) 1

68. Which of the following is *not* a component is the Wacker catalytic cycle ?

(A) Ethylene (B) Oxygen

(C) Hydrogen (D) Acetaldehyde

69. Quenching of the orbital contribution to the magnetic moment is observed due to the ligand field in electronic configuration :

(A) $e^2 t_2^1$ (B) $e^4 t_2^4$

(C) $e^4 t_2^5$ (D) $e^4 t_2^3$

70. The compound trans–Fe (*o*-phen)$_2$ (NCS)$_2$ has a magnetic moment of 0.65 B.M. at 80 K, increasing with temperature to 5.2 B.M. at 300 K. This phenomenon is known as :

(A) Spin pairing (B) Spin canting

(C) Spin crossover (D) Spin flip

71. Which of the following pairs of coordination complexes undergo inner sphere electron transfer reaction ?

(A) $[Co(NH_3)_5Cl]^{2+}/[Cr(OH_2)_6]^{2+}$

(B) $[Co(NH_3)_5SCN]^{2+}/[Cr(OH_2)_6]^{2+}$

(C) $[Co(NH_3)_5H_2O]^{3+}/[Cr(OH_2)_6]^{2+}$

(D) $[Co(NH_3)_6]^{3+}/[Cr(OH_2)_6]^{2+}$

72. The most powerful detector/s used in gas chromatography is :

(A) Flame ionization detectors

(B) Thermal conductivity detectors

(C) Electron capture detectors

(D) Mass spectrometer detector

73. Racemization of octahedral complexes containing three bidentate chelate rings by the Bailar twist mechanism forms a intermediate of ..... point group

(A) D_{3h} (B) C_{2v}

(C) C_{3v} (D) D_{2h}

74. The ^{31}P NMR Spectra of mer-Rh (PPh_3) Cl_3 (I = Rh = P = 1/2) exhibits :

(A) doublet of doublet and doublet of triplet

(B) doublet of doublet and triplet of triplet

(C) doublet of doublet

(D) doublet of triplet

75. ^{57}Fe Mössbauer spectra of (*i*) $FeCO_5$, (*ii*) Fe_2CO_9 and (*iii*) Fe_3CO_{12} shows :

(A) All compounds show doublet Mössbauer lines

(B) (*i*) and (*iii*) show doublet, while (*ii*) shows a doublet and a singlet Mössbauer lines

(C) All compounds show a singlet Mössbauer line

(D) (*i*) and (*ii*) show doublet while (*iii*) will show a doublet and a singlet

ROUGH WORK