Total Printed Pages : **16**

Booklet No.

M.Phil./Ph.D. ADMISSION TEST, 2018

Paper II

Subject : 107 - CHEMISTRY

Roll No. (In figures) ..... (In words) .....

OMR Sheet Sr. No. .....

Signatures of Invigilators 1. ..... 2. .....

Names of Invigilators 1. ..... 2. .....

Time : 2 Hours

Max. Marks : 200

SEAL

GENERAL INSTRUCTIONS

1. Read the instructions given on the Question Booklet and OMR Sheet before starting the answers. All the entries should be filled by **blue or black ball point pen**.

2. The Question Booklet contains **100** questions and all questions are compulsory.

3. Each question is of **2** marks. There is **no negative marking**.

4. Candidates must ensure that the Question Booklet issued to them has all the questions. Defective Question Booklet can be got changed within **10** minutes.

1. प्रश्नों के उत्तर लिखने से पूर्व प्रश्न-पुस्तिका और ओ.एम.आर. शीट पर दिये हुए निर्देश पढ़ें। सभी प्रविष्टियाँ **नीले अथवा काले बॉल पॉइन्ट पेन** से भरें।

2. प्रश्न-पुस्तिका में **100** प्रश्न हैं और सभी प्रश्न अनिवार्य हैं।

3. प्रत्येक प्रश्न **2** अंक का है। कोई **नकारात्मक अंकन (negative marking)** नहीं होगा।

4. परीक्षार्थी सुनिश्चित कर लें कि उन्हें जो प्रश्न-पुस्तिका दी गई है उसमें सभी प्रश्न अंकित हैं। त्रुटिपूर्ण प्रश्न-पुस्तिका **10** मिनट की अवधि में बदलवाई जा सकती है।

5. In case of any discrepancy between English and Hindi versions of a question, English version will be taken as correct, wherever there are both versions.

6. Select and darken the circle corresponding to the answer [(A) or (B) or (C) or (D)] in OMR sheet.

7. In case more than one circles are darkened in a question, it will not be evaluated.

8. Do not make any stray marks on OMR sheet and do not fold it.

9. Any candidate found removing pages from the Question Booklet may be disqualified and prosecuted.

10. Use of unfair means will disqualify the candidate from the examination.

11. Cell phone, calculator or any such devices are not allowed in the Examination Hall.

12. No candidate is allowed to leave the seat before handing over the original OMR sheet to the invigilator. Candidate can take Question Booklet and Carbon copy of OMR sheet.

5. किसी प्रश्न के अंग्रेजी और हिन्दी रूपान्तरणों में भिन्नता होने की स्थिति में अंग्रेजी रूपान्तरण सही माना जायेगा जहाँ प्रश्न-पत्र दोनों भाषाओं में है।

6. सही उत्तर का चयन करें तथा सम्बन्धित [(A) अथवा (B) अथवा (C) अथवा (D)] गोले को ओ.एम.आर. शीट में काला करें।

7. किसी प्रश्न में एक से अधिक गोले को काला करने पर उसे जाँचा नहीं जायेगा।

8. ओ.एम.आर. शीट पर किसी तरह का चिह्न न बनायें और न ही उसे मोड़ें।

9. प्रश्न-पुस्तिका से पृष्ठ निकालते हुए पाये जाने पर परीक्षार्थी को अयोग्य घोषित किया जा सकता है और उसके विरुद्ध विधिक कार्यवाही भी की जा सकती है।

10. अनुचित साधनों का उपयोग करने पर परीक्षार्थी को परीक्षा के लिए अयोग्य घोषित कर दिया जायेगा।

11. सेलफोन, संगणक और ऐसी किसी भी अन्य प्रविधियों को परीक्षा भवन में लाने की अनुमति नहीं है।

12. ओ.एम.आर. शीट की मूल प्रति वीक्षक को सुपुर्द किये बिना किसी भी परीक्षार्थी को अपना स्थान छोड़ने की अनुमति नहीं है। परीक्षार्थी प्रश्न-पुस्तिका एवं ओ.एम.आर. शीट की कार्बन प्रति को अपने साथ ले जा सकेगा।

1. The first ionization energy is the lowest for :
   (A) I
   (B) Te
   (C) Sb
   (D) As

2. Which of the following has the lowest melting point ?
   (A) LiCl
   (B) NaCl
   (C) KCl
   (D) RbCl

3. The hybridization of P in PO_4^{3-} is the same as that of :
   (A) S in SO_3
   (B) N in NO_3^-
   (C) I in ICl_2^+
   (D) I in ICl_4^+

4. Among ClO_3^-, XeO_3 and SO_3 species with trigonal Pyramidal shape is/are :
   (A) ClO_3^- and XeO_3
   (B) XeO_3 and SO_3
   (C) ClO_3^- and SO_3
   (D) SO_3

5. The compound that will behave as an acid in H_2SO_4 is :
   (A) CH_3COOH
   (B) HNO_3
   (C) $HClO_4$
   (D) H_2O

6. The role of BF_3 as an industrial polymerization catalyst is to generate :
   (A) Carbanion
   (B) Carbocation
   (C) Organic radical
   (D) Cation radical

7. Condensation of which of the following gives cross linked silicone ?
   (A) Trialkyl silanol
   (B) Dialkyl silandiol
   (C) Alkyl silantriols
   (D) Silanol

8. Tendency of donor atoms to complex with class (a) metal ions is :
   (A) N > P > As > Sb
   (B) N < P < As < Sb
   (C) S > O > Se > Te
   (D) O < S < Se ≈ Te

9. The STYX code for diborane is :
   (A) 2020
   (B) 2200
   (C) 2002
   (D) 0220

10. Which one of the following pairs consists of a good oxidizing and good reducing agent respectively ?
   (A) Ce(III), In(III)
   (B) Ce(IV), Eu(II)
   (C) Ce(III), Eu(II)
   (D) Ce(IV), Sm(II)

11. Which of the following lanthanide(III) ions have magnetic moment closest to the spin only value ?
   (A) Gd(III)
   (B) Dy(III)
   (C) Nd(III)
   (D) Eu(III)

12. Which of the following catalyst is used for homogeneous hydrogenation ?
   (A) $RhCl(PPH_3)_3$
   (B) $RhClH_2(PPH_3)_3$
   (C) $RhCl_2(CO)_2$
   (D) $Co_2(CO)_8$

13. An example of a metal cluster with no bridging ligands is :
   (A) $Fe_2(CO)_9$
   (B) $Fe_3(CO)_{12}$
   (C) $Co_2(CO)_9$
   (D) $Mn_2(CO)_{10}$

14. The treatment of C_6H_5I with C_4H_9Li yields :

(A) $C_6H_6 + I_2 + Li$

(B) C_6H_6 + Butane + LiI

(C) Octane + 2LiI

(D) $C_6H_5Li + C_4H_9I$

15. The number of metal-metal bonds in $Co_4(CO)_{12}$ is :

(A) 6

(B) 4

(C) 10

(D) 12

16. The naked haem without the bound globin is oxidized irreversibly to :

(A) Methaemoglobin

(B) Haematin

(C) Metmyoglobin

(D) Ferritin

17. Which of the following is blue copper electron transfer protein ?

(A) Ferredoxins

(B) Rubredoxin

(C) Plastocyanin

(D) Transferrin

18. Which of the following enzymes require Zn(II) for enzymatic activity ?

(a) Superoxide dismutase

(b) Carboxypeptidase

(c) Catalase

(d) Xanthine oxidase

The **correct** answer is :

(A) (a) only

(B) (a) and (d)

(C) (a) and (b)

(D) (a), (b) and (c)

19. Chelate effect is :

(A) due to enthalpy change

(B) due to entropy change

(C) due to equal contribution of entropy and enthalpy change

(D) independent of ring size

20. The geometry and oxidation state of Nickel in $[Ni(CO)_4]$:

(A) tetrahedral, +2

(B) tetrahedral, zero

(C) square planar, +2

(D) square planar, zero

21. The $\Delta 0$ of the following complexes follows the order :

(a) $[CrF_6]^{3-}$

(b) $[CrCl_6]^{3-}$

(c) $[Cr(NCS)_6]^{3-}$

(A) (c) > (a) > (b)

(B) (a) > (b) > (c)

(C) (b) > (a) > (c)

(D) (c) > (b) > (a)

22. The species with highest magnetic moment (spin only value) is :

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

(B) $(\eta^5 - C_5H_5)_2Cr$

(C) $[Mn(CN)_6]^{3-}$

(D) $[VCl_6]^{4-}$

23. Which one of the following pairs of electronic configurations of low spin (3d) transition metal ions in an octahedral field undergoes a strong John Teller distortion ?

(A) d^1, d^9

(B) d^6, d^2

(C) d^4, d^3

(D) d^7, d^9

24. For high spin $[Co(F_6)]^{3-}$ and low spin $[Co(en)_3]^{3+}$ complexes (d^6), the generally observed spin allowed transitions, respectively are :

(A) two and one

(B) one and two

(C) zero and one

(D) two and two

25. Which of the following is a Pi acid ligand ?

(A) F^-

(B) H_2O

(C) CO_2

(D) PF_3

26. What is the total number of vibrational modes expected respectively for ?

(a) H_2S

(b) CO

(c) NH_3

(d) $Ni(CO)_4$

The **correct** answer is :

(A) 3, 1, 6, 21

(B) 3, 1, 6, 3

(C) 3, 1, 6, 9

(D) 1, 3, 6, 21

27. The commonly used nuclide in Mossbauer spectroscopy is :

(A) ^{19}F

(B) ^{29}Si

(C) ^{31}P

(D) ^{119}Sn

28. How many different ^{13}C Chemical environment are there in $(\eta^2 - C_2H_4)Pt(PEt_3)_2$?

(A) three

(B) four

(C) two

(D) five

29. In ultraviolet spectroscopy blue shift involves the shift of absorption maximum towards shorter wavelength, It is also called :

(A) Hyperchromic shift

(B) Hypochromic shift

(C) Hypsochromic shift

(D) Bathochromic shift

30. Which of the following metals and their complexes are used as antiarthritis drugs ?

(A) Hg and Pb

(B) Pd and Pt

(C) Co and Fe

(D) Cu and Au

31. For neutron activation analysis of an element the favourable characteristics of both the target and the product are from the following :

(a) high neutron cross-section area of target.

(b) long half-life of the product.

(c) low neutron cross-section area of target.

(d) low half-life time of the product.

(A) (a) and (b)

(B) (b) and (c)

(C) (c) and (d)

(D) (a) and (d)

32. The ground state term for d^2 configuration is :

(A) ^2D

(B) ^5D

(C) ^3F

(D) ^4F

33. The half-life $\left(t_{1/2}\right)$ for a radioactive nuclei is given by :

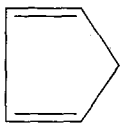
(A) $t_{1/2} = \frac{\log\left(\frac{1}{2}\right)}{l}$

(B) $t_{1/2} = \frac{0.693}{l}$

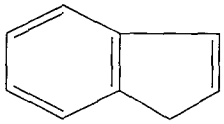
(C) $t_{1/2} = \frac{0.693}{T}$

(D) $t_{1/2} = \frac{\ln\left(\frac{1}{2}\right)}{T}$

34. pKa value of some hydrocarbons are given below :



(a) -18.1



(b) -20.1

$(C_6H_5)_3CH$

CH_4

(c) -29

(d) -48

Arrange stability of carbanions obtained from these hydrocarbons in decreasing order. Select the **correct** answer from the codes given below :

(A) (a) > (b) > (c) > (d)

(B) (d) > (c) > (b) > (a)

(C) (b) > (a) > (c) > (d)

(D) (d) > (a) > (b) > (c)

35. Geometry of Trifluorozomethyl free radical is :

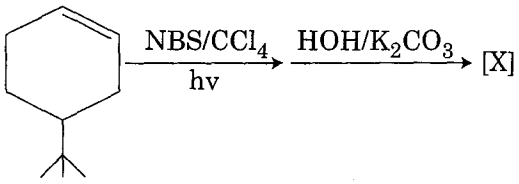
(A) Planer

(B) Pyramidal

(C) V-shaped

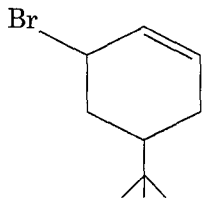
(D) Tetrahedral

36. In the given reaction :

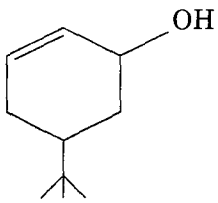


[X] will be :

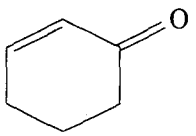
(A)



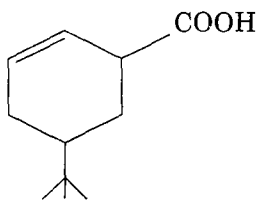
(B)



(C)

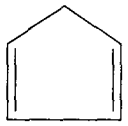


(D)

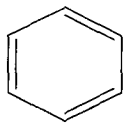


37. Benzyne can be trapped by which of the following ?

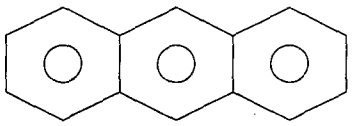
(a)



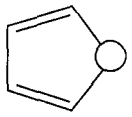
(b)



(c)



(d)



Select the **correct** answer from the codes given below :

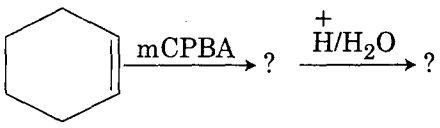
(A) Only (a)

(B) Only (c) and (d)

(C) (b), (c) and (d)

(D) (a), (c) and (d)

38. In the following reaction the final product formed is :



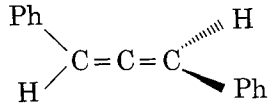
(A) cis

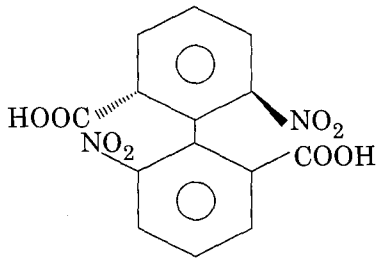
(B) trans

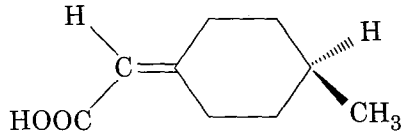
(C) cis and trans both

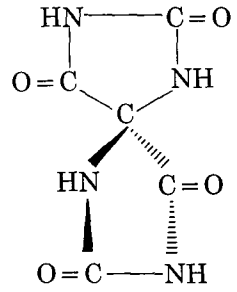
(D) None

39. Which molecule has R configuration ?

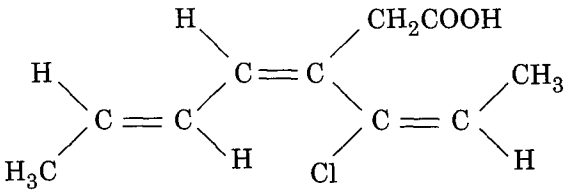
(A) 

(B) 

(C) 

(D) 

40. Correct E and Z nomenclature of the given compound is :



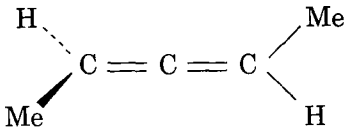
(A) 3-[E-1-Chloropropenyl]-(3Z, 5E)-3, 5 - heptanedioic acid

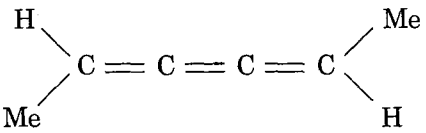
(B) 3-[Z-1-Chloropropenyl]-(3E, 5E)-3, 5 - heptanedioic acid

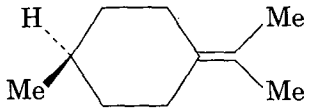
(C) 4-[E-4-Chloropropenyl]-(3E, 5E)-3, 5 - heptanedioic acid

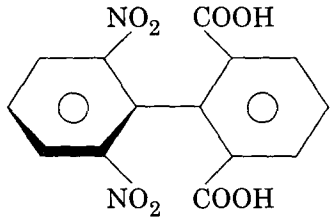
(D) 4-[Z-4-Chloropropenyl]-(3E, 5E)-3, 5 - heptanedioic acid

41. Which one of the following is Chiral Molecule ?

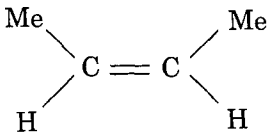
(A) 

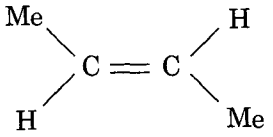
(B) 

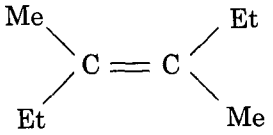
(C) 

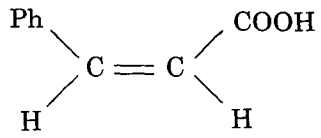
(D) 

42. Which of the following will give meso form with Baeyer's reagent ?

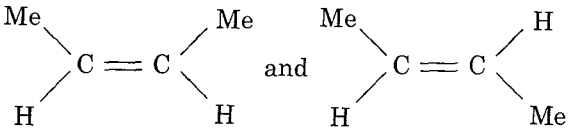
(A) 

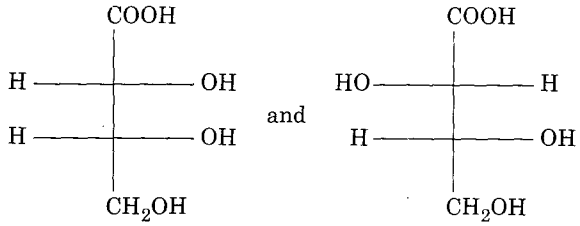
(B) 

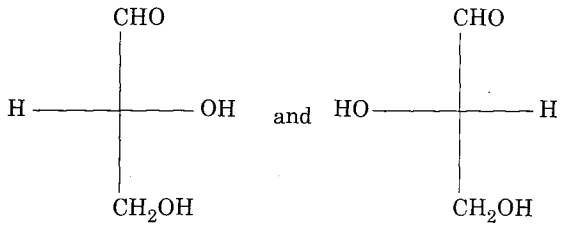
(C) 

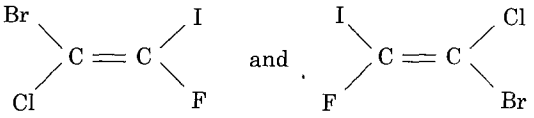
(D) 

43. Which among the following pairs are diastereomers ?

(a) 

(b) 

(c) 

(d) 

Select the **correct** answer from the codes given below :

(A) Only (b)

(B) Only (a)

(C) (a) and (b)

(D) (a), (b) and (d)

44. Using the given codes, arrange the following compounds in decreasing order of reactivity towards an electrophile :

Benzene (a)	Chlorobenzene (b)
Phenol (c)	Aniline (d)

Codes :

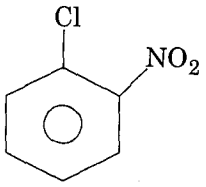
(A) (a) > (b) > (c) > (d)

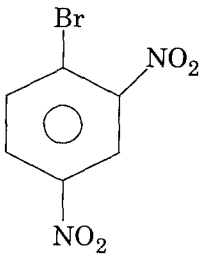
(B) (d) > (c) > (a) > (b)

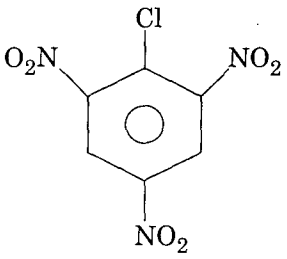
(C) (c) > (d) > (a) > (b)

(D) (b) > (a) > (c) > (d)

45. Which among the following compounds will undergo Ar SN_2 reaction ?

(A) 

(B) 

(C) 

(D) All of these

46. Which of the following will undergo free radical bromination most readily ?

(A) CH_3COOH

(B) CH_3COCl

(C) CH_3CH_2COOH

(D) $HOOCCH_2CH_2COOH$

47. Which among the following reagents gives syn- addition with alkene ?

(a) Br_2

(b) Dil. $KMnO_4$ / $\bar{O}H$

(c) $OSO_4/NaHSO_3$ / HOH

(d) $H_2/Ni/\Delta$

Select the **correct** answer from the codes given below :

(A) Only (a)

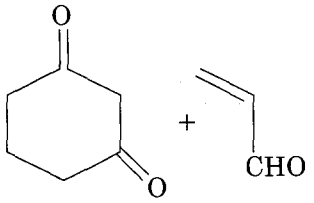
(B) (b) and (c)

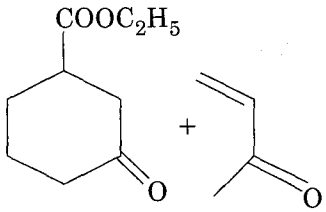
(C) (b), (c) and (d)

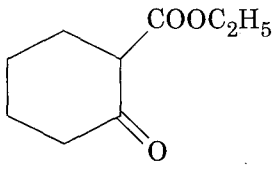
(D) Only (d)

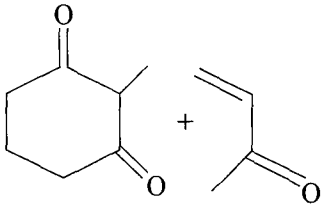
48. Name the reaction at carbonyl group with the loss of carbonyl oxygen atom.
(A) Aldol condensation
(B) Crossed aldol condensation
(C) Wittig reaction
(D) None of the above

49. Which one of the following pair will **not** give Robinson annelation reaction ?

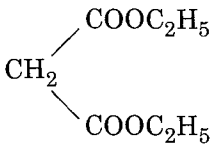
(A) 

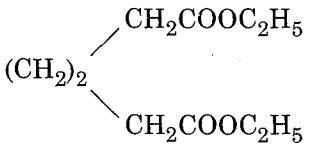
(B) 

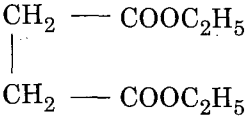
(C) 

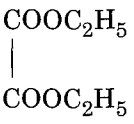
(D) 

50. Stobbe condensation is given by :

(A) 

(B) 

(C) 

(D) 

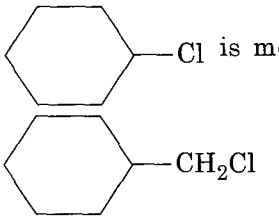
51. Which among the following will be least reactive in SE^2(back) reaction (L = leaving group) ?
(A) Me – L
(B) $Me_2CH - L$
(C) $Me_3C - L$
(D) Et – L

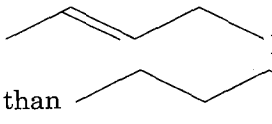
52. Which one of the following reactions will take place most readily at bridgehead carbon in a [2, 2, 1] bicyclic system ?
(A) SN_1
(B) SE_1
(C) SE_2 (back)
(D) SN^2

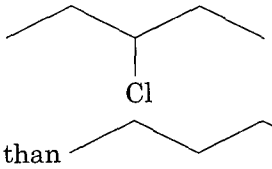
53. $(CH_3CH_2N)_3N \xrightarrow{NaNO_2/aq.HCl}$ product (s)

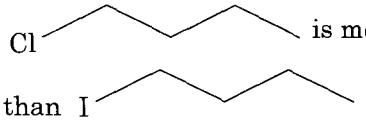
In the above reaction the product (s) is/are :
(A) CH_3CHO only
(B) $(CH_3CH_2)_2NH$ only
(C) CH_3CHO and $(CH_3CH_2)_2N - NO$
(D) CH_3CHO and $(CH_3CH_2)_2NH$

54. Which one of the following statements is **correct** for the reactivity in SN_2 reactions ?

(A)  Cl is more reactive than CH_2Cl

(B)  I is more reactive than I

(C)  is more reactive than Cl

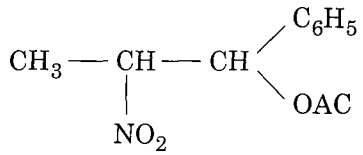
(D)  is more reactive than I

55. Using the following codes, arrange the given compounds in order of their decreasing reactivity towards SN^1 reaction.
Benzyl chloride (a) p-methoxybenzylchloride (b)
p-Nitrobenzyl chloride (c)
(A) (a) > (b) > (c)
(B) (b) > (a) > (c)
(C) (c) > (b) > (a)
(D) (b) > (c) > (a)

56. Which of the following compounds gives E1cb reaction ?

(a) $CF_3 - CHCl_2$

(b) $C_6H_5CH_2 - CH_2F$

(c) 

(d) $CH_3 - CH_2 - CH_2F$

Select the **correct** answer from the codes given below :

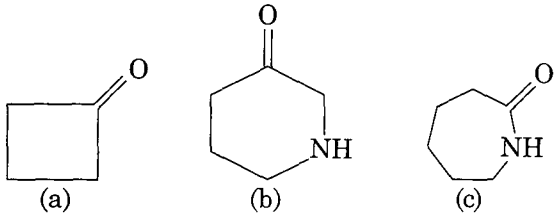
(A) Only (a) and (b)

(B) Only (b) and (c)

(C) Only (c) and (d)

(D) (a), (b) and (c)

57. Arrange the following compounds in order of their decreasing wave number of absorption.



(A) (a) > (b) > (c)

(B) (b) > (c) > (a)

(C) (c) > (b) > (a)

(D) (a) > (c) > (b)

58. The natural abundance of ^{13}C is about :

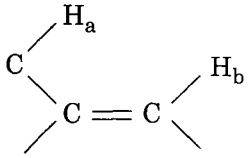
(A) Four times less than ^1H

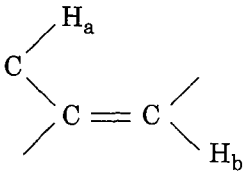
(B) 0.11% of total carbon

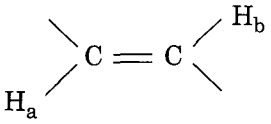
(C) 1.1% of total carbon

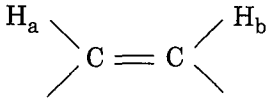
(D) 99% of total carbon

59. Which of the following molecules has the largest 3JHH coupling constant between H_a and H_b ?

(A) 

(B) 

(C) 

(D) 

60. The ^1HNMR spectrum of $CH_3OCHCl\ CH_2Cl$ will exhibit _____.

(A) Three proton doublet, one proton singlet and a two proton doublet.

(B) Three proton singlet, one proton singlet and a two proton doublet.

(C) Three proton singlet, one proton triplet and a two proton doublet.

(D) Three proton triplet, one proton triplet and a two proton doublet.

61. What is the **correct** order of reactivity (most reactive first) of pyrrole, furan and thiophene towards electrophile ?

(A) Furan > Thiophene > Pyrrole

(B) Thiophene > Pyrrole > Furan

(C) Furan > Pyrrole > Thiophene

(D) Pyrrole > Furan > Thiophene

62. Which reagent would you use to convert 2 - Pyridene to 2 - chloropyridine ?

(A) HCl

(B) PCl_3

(C) CCl_4

(D) $POCl_3$

63. A terpene contain molecular formula $C_{15}H_{24}$ then it belongs to :

(A) Diterpene

(B) Triterpene

(C) Sesquiterpene

(D) Monoterpene

64. Camphor on reduction give :

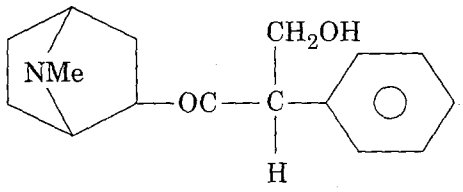
(A) Camphene

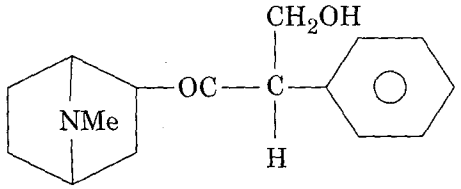
(B) Borneol and Isoborneol

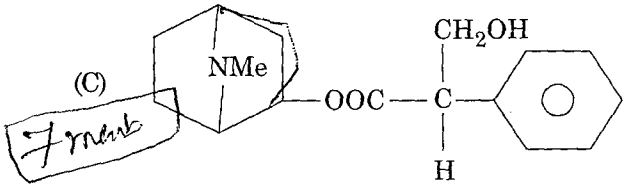
(C) Alpha Pinnane

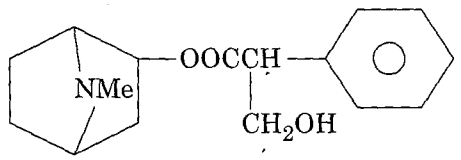
(D) Camphoric Acid

65. Correct structure of Atropine is :

(A) 

(B) 

(C) 

(D) 

66. Which statement about thiophene is **incorrect** ?

(A) The S atom contributes two electrons to the π-system.

(B) Oxidative polymerization of thiophene leads to a conducting polymer.

(C) Thiophene is more reactive towards electrophiles than furan.

(D) Thiophene is polar.

67. Consider the particle in a cubic box. The degeneracy of the level that has an energy twice that of the lowest level is :

(A) 3

(B) 1

(C) 2

(D) 4

68. The angular momentum operator $\hat{L}_y$ is :

(A) $\frac{-\hbar}{i}\left[y\frac{\partial}{\partial z} - z\frac{\partial}{\partial y}\right]$

(B) $\frac{\hbar}{i}\left[z\cdot\frac{\partial}{\partial x} - x\frac{\partial}{\partial z}\right]$

(C) $\frac{-i\hbar}{2m}\frac{\partial}{\partial x}$

(D) $\frac{\hbar}{i}\left[z\cdot\frac{\partial}{\partial x} - y\cdot\frac{\partial}{\partial y}\right]$

69. The point group of ClF_3 is _____.

(A) C_{3v}

(B) C_{2v}

(C) D_{2h}

(D) D_{3h}

70. The molecule with the smallest rotational partition function at any temperature among the following is _____.

(A) $CH_3 - C \equiv CH$

(B) $H - C \equiv C - H$

(C) $H - C \equiv C - D$

(D) $D - C \equiv C - D$

71. The **correct** thermodynamic relation among the following is :

(A) $\left(\partial u/\partial v\right)_s = -P$

(B) $\left(\partial H/\partial v\right)_s = -P$

(C) $\left(\partial G/\partial v\right)_s = -P$

(D) $\left(\partial A/\partial v\right)_s = -S$

72. The value of magnetic quantum no. of a p_z orbital is :

(A) -1

(B) $+1$

(C) 0

(D) Undefined

73. Which of the following is **correct** expression for Debye-Huckel Limiting Law (DHLL) ?

(A) $\log \gamma = +0.509/z_+ \cdot z_- /\sqrt{\mu}$

(B) $\log \gamma = -0.509/z_+ \cdot z_- /\mu$

(C) $\log \gamma = +0.509/z_+ \cdot z_- /\mu^2$

(D) $\log \gamma = -0.509/z_+ \cdot z_- /\sqrt{\mu}$

74. The intrinsic viscosity depends on molar mass as :

$\eta = K \cdot M^a$

The empirical constant 'K' and 'a' depend on :

(A) Solvent only

(B) Polymer only

(C) Polymer-Solvent pair

(D) Polymer-Polymer Interaction

75. Which of the following electrode is used as working electrode in Polarography ?

(A) Hydrogen electrode

(B) Saturated calomel electrode

(C) Dropping mercury electrode

(D) Ag/AgCl electrode

76. For an enzyme catalysis reaction :

$$E + S \underset{K-1}{\overset{K_1}{\rightleftharpoons}} ES \xrightarrow{K_2} P$$

The value of Micralis constant is :

(A) $\frac{K_1 + K_1}{K_2}$

(B) $\frac{K_{-1} + K_2}{K_1}$

(C) $\frac{K_2 + K_1}{K_{-1}}$

(D) $\frac{K_{-1} \cdot K_2}{K_1}$

77. Which of the following electronic transitions requires least amount of energy ?

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

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

(C) $\eta \rightarrow \sigma^*$

(D) $\eta \rightarrow \pi^*$

78. The selection rule for pure rotational Raman spectrum is :

(A) $\Delta J = \pm 1$

(B) $\Delta J = \pm 2$

(C) $\Delta J = 0$

(D) $\Delta J = 0, \pm 2$

79. Which of the following electronic transitions, is forbidden according to Laporte's rule ?

(A) $1s \rightarrow 2p$

(B) $1s \rightarrow 3d$

(C) $2s \rightarrow 3p$

(D) $2p \rightarrow 3d$

80. Molar ionic conductivities at infinite dilution of Na^+ and Cl^- ions are 50.11×10^{-4} and 76.34×10^{-4} $sm^2\,mol^{-1}$ respectively. Transport number of Na^+ and Cl^- ions at this dilution would be respectively :

(A) 0.396, 0.604

(B) 0.604, 0.396

(C) 0.500, 0.500

(D) 0.325, 0.675

81. The activation energy of a non catalysed reaction at 37°C is 83.68 kJ mol^{-1} and activation energy of same reaction catalysed by an enzyme is 25.10 kJ mol^{-1}. What will be the ratio of rate constants of enzyme catalysed and non catalysed reaction ?

(A) 10^{20}

(B) 10^{10}

(C) 10^{15}

(D) 10^{25}

82. The efficiency of an Carnot engine is $\frac{1}{6}$. On decreasing the temperature of sink by 65K the efficiency increases to $\frac{1}{3}$. The temperature of the sink would be :

(A) 52° C

(B) 102° C

(C) 25° C

(D) 0° C

83. 4 gms. of NaOH was dissolved in one litre of solution containing one mol of acetic acid and one mol of sodium acetate. What would be the pH of resulting solution ? (for acetic acid $K_a = 1.8 \times 10^{-5}$)

(A) 4.83

(B) 1.83

(C) 7.80

(D) 5.50

84. Which of the following expressions defines the absolute temperature of a system ?

(A) $\left[\frac{\partial U}{\partial S}\right]_V$

(B) $\left[\frac{\partial H}{\partial S}\right]_V$

(C) $\left[\frac{\partial A}{\partial T}\right]_V$

(D) $\left[\frac{\partial U}{\partial V}\right]_S$

85. If the atoms or ions in a crystal are taken to be hard sphere touching each other in the unit cell. Then fraction of volume occupied in B.C.C structure is :

(A) $\sqrt{3} \cdot \pi$

(B) $\frac{\sqrt{2} \cdot \pi}{6}$

(C) $\frac{\pi}{6}$

(D) $\frac{\sqrt{3} \cdot \pi}{8}$

86. Which of the following point groups is an example of Obelian point group ?

(A) C_{3V}

(B) D_{2h}

(C) D_{3h}

(D) D_{3d}

87. What will be the partition function of O_2 molecule (gas) at 1.0 atm. pressure and at 298 K temperature moving in a vessel of volume 24.4 dm^3 ?

(A) 4.28×10^{30}

(B) 4.28×10^{28}

(C) 4.28×10^{26}

(D) 4.28×10^{32}

88. Which of the following equation is used to calculate the pressure difference across a curved liquid surface ?

(A) Gibbs - Duhem equation

(B) Butler - Volmer equation

(C) BET equation

(D) Laplace equation

89. The energy of a 3D simple harmonic oscillator is $\frac{7}{2}$ hυ. The degeneracy of energy level is :

(A) 1

(B) 3

(C) 6

(D) 10

90. The delocalisation energy of allylic radical as per HMO approach is :

(A) $(\sqrt{2} - 1)\beta$

(B) $2\beta\ (\sqrt{2} - 1)$

(C) $2\beta\ (\sqrt{2} + 1)$

(D) $(\sqrt{2} + 1)\beta$

91. A molecular orbital of a diatomic molecule changes sign when it is rotated by 180° around the molecular axis. Orbital is :

(A) σ

(B) π

(C) δ

(D) φ

92. $t_{1/2}$ of first order reactions is given by $\frac{0.693}{K}$, $t\frac{3}{2}$ will be equal to _____.

(A) $\frac{0.693}{K}$

(B) $\frac{1.039}{K}$

(C) $\frac{1.386}{K}$

(D) $\frac{1.924}{K}$

93. For a first order reaction, half-life is 14 sec. The time required for the initial concentration to reduce to 1/8 of its original value is _____.

(A) 2744 sec.

(B) 28 sec.

(C) 42 sec.

(D) 196 sec.

94. The standard oxidation potential E° for the half cell reactions are as :

$Zn \rightarrow Zn^{+2} + 2\bar{e}$, $E^{\circ} = +0.76V$

$Fe \rightarrow Fe^{+2} + 2\bar{e}$, $E^{\circ} = +0.41V$

$Fe^{+2} + Zn \rightarrow Zn^{+2} + Fe$

The EMF of above cell would be :

(A) $-0.35\,V$

(B) $+0.35\,V$

(C) $+1.17\,V$

(D) $-0.117\,V$

95. The sequence of ionic mobility in the aqueous solution of the following ions is :

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

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

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

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

96. In the following reaction, the role of cadmium vapours is :

$$n\ CH_2{=}CH_2 \xrightarrow[h\upsilon]{\text{cd (vapour)}} (-CH_2-CH_2-)n$$

(A) As catalyst

(B) As promotor

(C) As an energy carrier

(D) All of the above

97. The **correct** expression for the product of $(\overline{Mn} \cdot \overline{M\omega})$, where $\overline{Mn}$ and $\overline{M\omega}$ are the number average and weight average molar masses respectively of a polymer, is :

(A) $N^{-1} \Sigma_i\ NiMi$

(B) $N^{-1} \Sigma_i\ NiMi^2$

(C) $N/\sum\limits_i NiMi$

(D) $N/\sum\limits_i NiMi^2$

98. Which of the following is **not** a non-radiative process ?

(A) Inter System Crossing (ISC)

(B) Internal Conversion (IC)

(C) Phosphorescence

(D) Above all are non-radiative process

99. The spectroscopic technique that can distinguish unambiguously between trans- 1, 2 - dichloroethylene and cis-1, 2 - dichloroethylene without any numerical calculation is :

(A) Microwave spectroscopy

(B) UV-Visible spectroscopy

(C) X-ray photoelectron spectroscopy

(D) γ-ray spectroscopy

100. Phosphorescence is represented by :

(A) $T_1 = S_0 + h\upsilon$

(B) $T_1 = S_0 + \Delta$

(C) $S_1 = S_0 + h\upsilon$

(D) $S_1 = T_1 + \Delta$

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