TEST BOOKLET No. **811**

TEST FOR POST GRADUATE PROGRAMMES

CHEMISTRY

Time: 2 Hours   Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.

2. Write your Roll Number in the space provided on the top of **this page**.

3. Also write your Roll Number, Test Code, and Test Subject in the columns provided for the same on the **Answer Sheet**. Darken the appropriate bubbles with a **Ball Point Pen.**

4. The paper consists of 150 objective type questions. All questions carry equal marks.

5. Each question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble fully by a **Ball Point Pen** corresponding to the correct response as indicated in the example shown on the Answer Sheet.

6. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.

7. Space for rough work is provided at the end of this Test Booklet.

8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet.

9. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happenings, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.
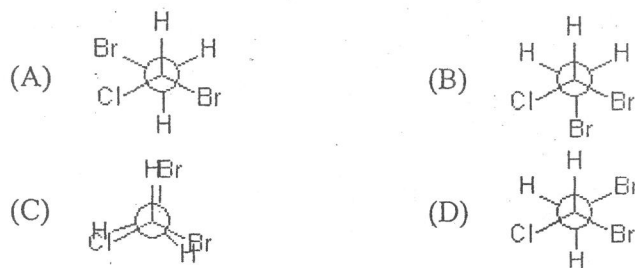
SEAL

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CHEMISTRY

1. Which of the following compounds has the highest boiling point?

   (A) CH_3I (B) CH_3OH

   (C) CH_3NO_2 (D) CH_3NH_2

2. The Newman projection which shows the most stable conformation of the compound, $BrClHC-CH_2Br$ is

   (A)

   (B)

   (C)

   (D)

3. The number of dichlorinated isomers formed by the halogenation of $CH_3CH_2CH_2CH_3$ with Cl_2 in the presence of light is
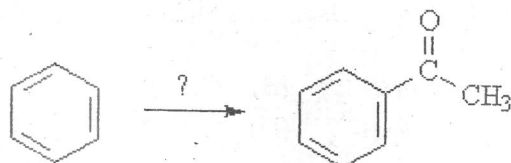
   (A) 2 (B) 3

   (C) 5 (D) 6

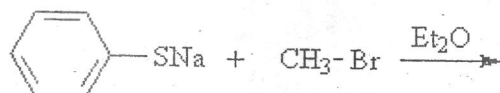4. Which of the following is an intermediate in the reaction of benzene with CH_3Cl and $AlCl_3$?

   (A)

   (B)

   (C)

   (D)
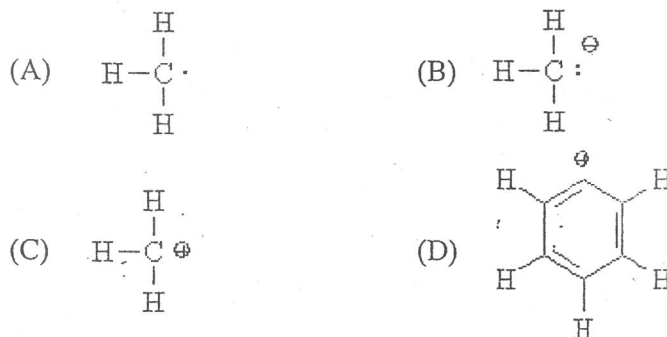
5. Which of the following are the best reactants in the following synthesis?

(A) $CH_3CH_2Cl + AlCl_3$ (B) $CH_3COOH + AlCl_3$

(C) $CH_3COCl + AlCl_3$ (D) $CH_3CHO + AlCl_3$

6. What is the major product in the following reaction?

(A)   (B)

(C)   (D)

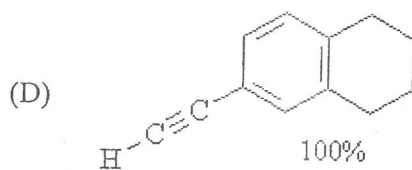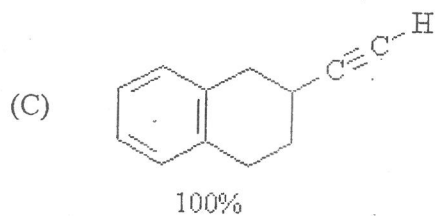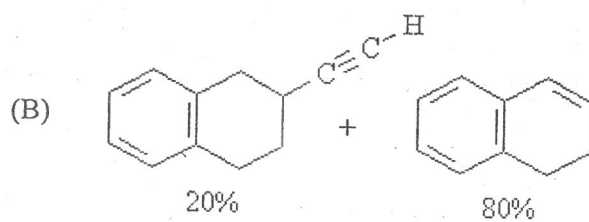7. Which of the following halides will react most rapidly in a S_N2 reaction?

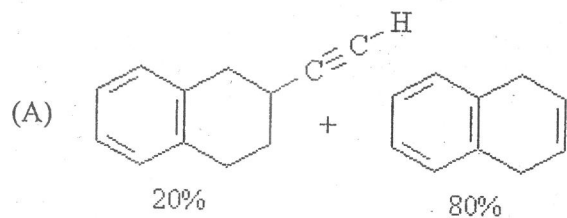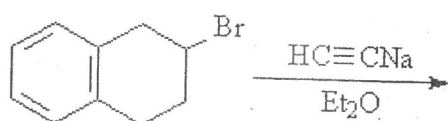(A) CH_3F (B) CH_3Cl

(C) CH_3Br (D) CH_3I

3

8. The product/s obtained from the following reaction is/are

(A) 20% + 80%

(B) 20% + 80%

(C) 100%

(D) 100%

9. The major product of the following reaction is

(A)

$$CH_3-CH-CH_2-CH_3$$
$$\quad\quad |$$
$$\quad\quad O$$
$$\quad\quad\quad \backslash CH_3$$

(B) $H_2C=CH-CH_2-CH_3$

(C)

(D)
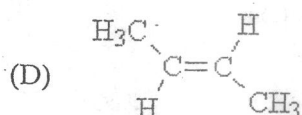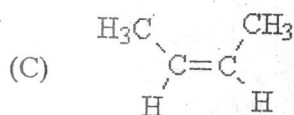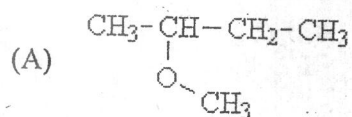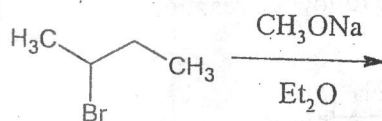
10. The number of moles of oxygen required for the complete combustion of C_3H_8 is

(A) 3

(B) 3.5

(C) 1.5

(D) 5

11. The major product of the following reaction

(A)

(B)

(C)

(D)
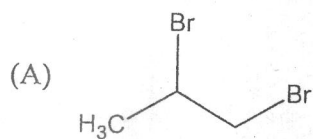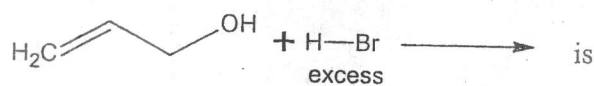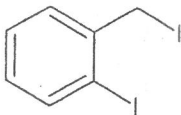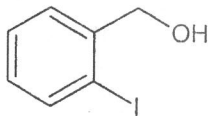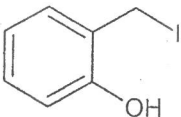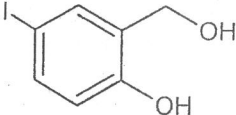
12. When isopropanol and t-butanol are treated with acidified $KMnO_4$,

(A) $KMnO_4$ gets decolourised due to the oxidation of both the reactants

(B) $KMnO_4$ gets decolourised due to the oxidation of isopropanol only

(C) $KMnO_4$ gets decolourised due to the oxidation of t-butanol only

(D) $KMnO_4$ does not get decolourised

13. Choose the true statement from among the following, with respect to cyclohexanol and phenol.
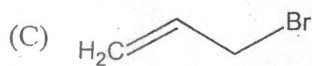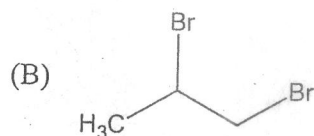
(A) Cyclohexanol is a better proton donor due to the inductive effect

(B) Phenol is a better proton donor due to the inductive effect

(C) Cyclohexanol is a better proton donor due to the resonance stabilisation of the anion formed.

(D) Phenol is a better proton donor due to the resonance stabilisation of the anion formed

14.

The product in the above reaction is
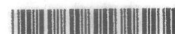
15. The major product of the reaction,

$$H_3C-\!\!\!\equiv\!\!\!N \xrightarrow[\text{Et}_2\text{O}]{\text{CH}_3\text{MgI}} \xrightarrow{\text{H}_3\text{O}^+} \text{is}$$

(A)

(B)

(C)

(D)
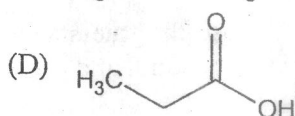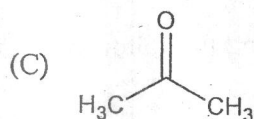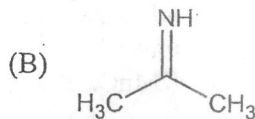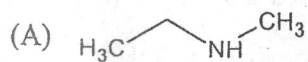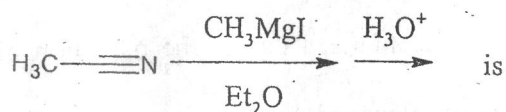
16. Which of the functional groups on the following molecule are susceptible to nucleophilic attack?
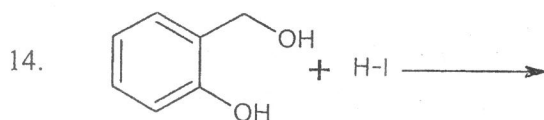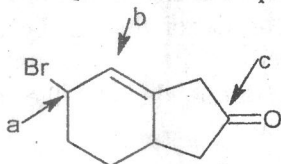

    (A) 'a', 'b' and 'c'   (B) 'a'and 'c'
    (C) 'b' and 'c'   (D) 'a', and 'b'

17. In allene (C_3H_4), the types of hybridisation of the terminal and the central carbon atoms are, respectively,

    (A) sp^3 and sp^2 (B) sp^2 and sp^2
    (C) sp^2 and sp (D) sp and sp

18. The number of chiral carbon atoms present in 2, 3, 4 – trichloropentane is

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

19. Which one of the following statements is not true regarding lactose?

    (A) It contains 8-OH groups

    (B) It is a β-glycoside

    (C) Its hydrolysis products are glucose and galactose

    (D) It is reducing sugar

20. Which among the following molecules will give acetone on zonolysis?
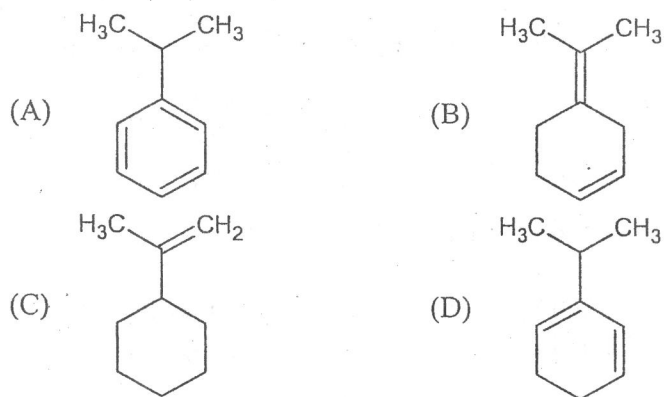
21. The following reaction coordinate diagram represents
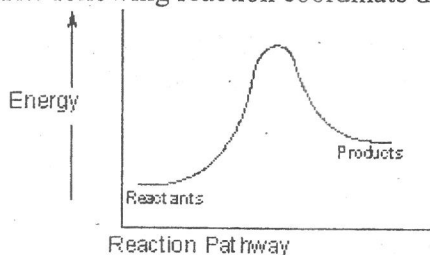
    (A) an endothermic reaction

    (B) an exothermic reaction

    (C) a catalytic reaction

    (D) a reaction with no energy change

22.

$$CH_3$$
H———OH   HO———CH_3
Br———H   H———C_2H_5
$$C_2H_5$$ $$Br$$
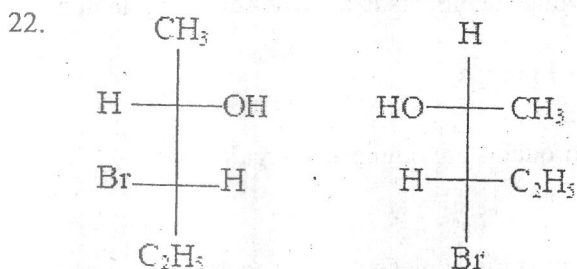
The molecules represented by the above two structures are

(A) identical

(B) enantiomers

(C) diastereomers

(D) epimers

23. Pyridine undergoes electrophilic substitution reaction preferentially

(A) at position 2

(B) at position 3

(C) at position 4

(D) at positions 2 and 4

24. S_N1 reaction on optically active substrate mainly gives

(A) retention in configuration

(B) inversion in configuration

(C) racemic product

(D) no product

25. Osmium tetroxide is a reagent used for

(A) hydroxylation of acetylenes

(B) hydroxylation of olefins to give cis diols

(C) hydroxylation of olefins to give trans diols

(D) hydroxylation of carbonyl compounds

26. In Reimer-Tiemann reaction the possible electrophile is

(A) dichloro carbene

(B) $^{\oplus}CHO$

(C) $^{\oplus}CHCl_2$

(D) None of the above

27. How many sigma bonds are present in the following compound?

$$H_3C-\underset{H}{C}=C=\underset{H}{C}-C\equiv CH$$
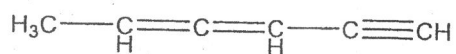
(A) 8
(B) 11
(C) 10
(D) 14

28. Best reagent to convert isopropyl alcohol to isopropyl bromide is

(A) HBr
(B) $SOBr_2$
(C) Br_2
(D) CH_3MgBr

29. Number of isomeric hexane (C_6H_{12}) existing

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

30. What is the major product of the following reaction sequence?

(i) H_3PO_4

(ii) $150°C$ $PhCO_3H$

(A)

(B)

(C)

(D)
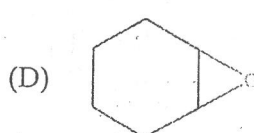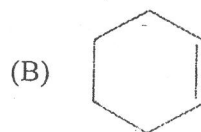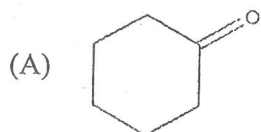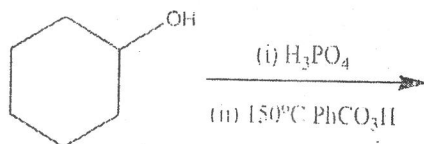
31. Pick out the strongest nucleophile

    (A) $\overset{\ominus}{O}H$ (B) $\overset{\ominus}{O}CH_3$

    (C) $\overset{\ominus}{H}$ (D) $Ph\text{-}\overset{\ominus}{O}$
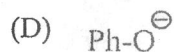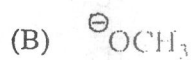
32. Pick out the major product

    (A)   (B)

    (C)   (D)
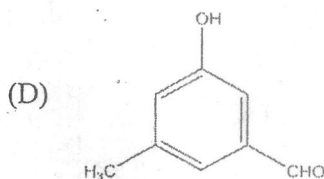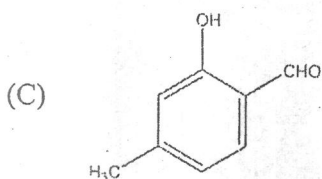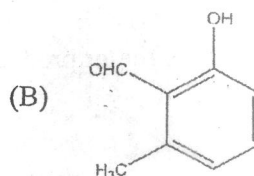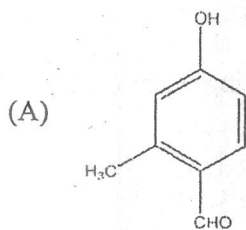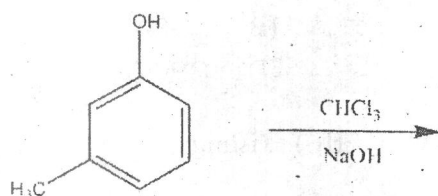
33. A water soluble $C_6H_{14}O_2$ compound is oxidized by lead tetra acetate to a single carbonyl (C_3H_6O) compound. Which of the following would satisfy this fact?

    (A) meso-2,3-dimethoxybutane
    (B) 1,2-dimethoxyethane
    (C) meso-2,5-hexanediol
    (D) meso-3,4-hexanediol

34. Which two of the following compounds represent a pair of enantiomers?
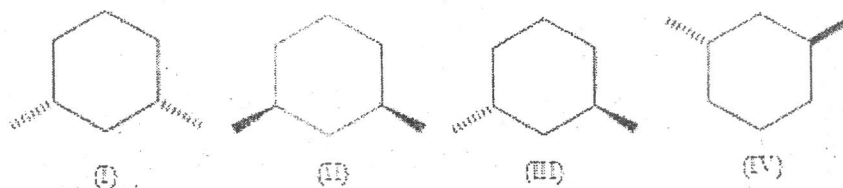
    (I)   (II)   (III)   (IV)

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

35. Pick out the non aromatic compound

    (A)   (B)

    (C)   (D)
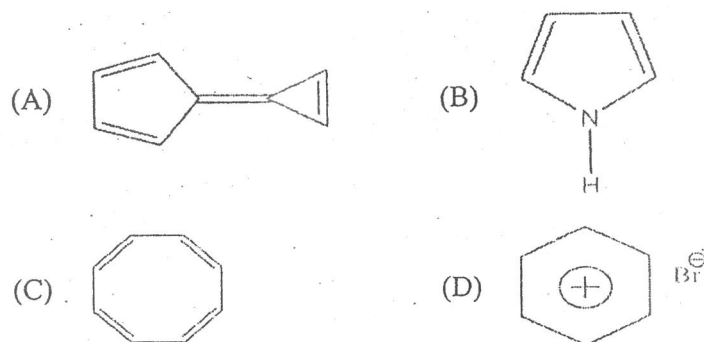
36. Arrange the following carbanions in the following series in order of increasing stability.

$(CH_3)_2\overset{\ominus}{CH}$ $CH_2=CH-\overset{\ominus}{CH_2}$ $\overset{\ominus}{CH_3}$
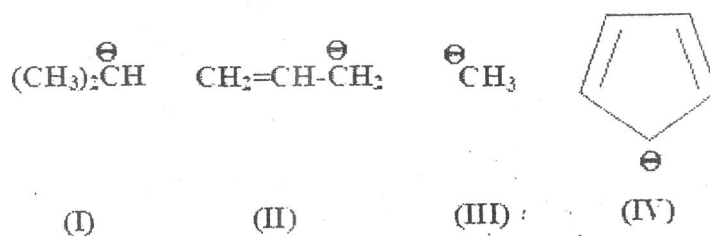
    (I)   (II)   (III)   (IV)

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

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37. Choose the most basic compound from the following

(A)

(B)

(C)

(D)
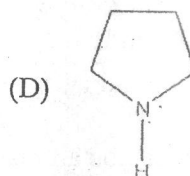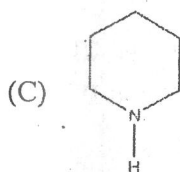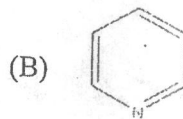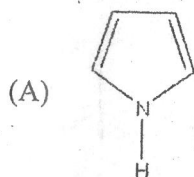
38. Pick out the structure of a diazonium ion

(A) Ph—N≡≡N

(B) Ph—N≡≡N⁺

(C) Ph—N⁺≡≡N

(D) Ph—N≡≡NH⁺
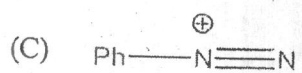
39. Which of the following molecule is a bicycle [2.2.0] hexane?

(A)

(B)

(C)

(D)

13
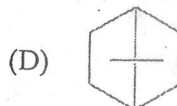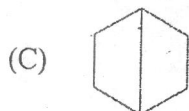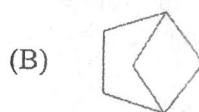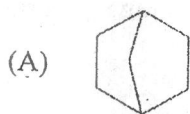
40. Primary amines are neutral because

(A) protons attached to NH_2 not liable
(B) react with base and undergo hydrolysis
(C) lone pair on NH_2 unavailable for protonation
(D) carbonyl group undergoes protonation

41. Systematic name for
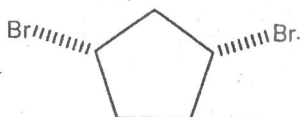
(A) cis 1,4-dibromocyclopentane
(B) trans 1,4-dibromocyclopentane
(C) cis 1,3-dibromocyclopentane
(D) trans 1,3-dibromocyclopentane

42. Cyanide ion is the best catalyst for benzoin condensation because it is

(A) a good nucleophile
(B) a good leaving group
(C) a good nucleophile and leaving group
(D) soluble in water and alcohol

43. Which one of the following bonds shows strongest absorption in the IR?

(A) C-H   (B) O-H
(C) N-H   (D) S-H

44. What is the λ_{max} of the following compound?
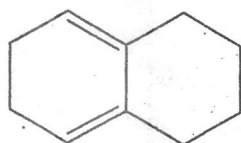
Base value= 253 or 214 nm: Alkyl group= +5 nm: Exocyclic = +5 nm

(A) 234 nm
(B) 244 nm
(C) 273 nm
(D) 283 nm

45. Number of ^{1}H NMR signals observed in the following compound is
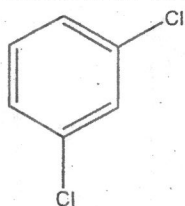
(A) 1
(B) 2
(C) 3
(D) 4

46. Predict the number of ^{13}C NMR signals in the following compound.

(A) 7
(B) 8
(C) 6
(D) 10
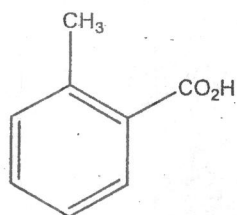
47. Which one of the following compounds is most likely to have its base peak at m/z=43?

(A)
$$H_3C—\underset{\underset{H}{|}}{\overset{\overset{Cl}{|}}{C}}—\underset{H_2}{C}—CH_3$$

(B)
$$H_3C—\underset{H_2}{C}—\underset{H_2}{C}—CHO$$

(C)
$$H_3C—\overset{\overset{O}{||}}{C}—C_6H_5$$

(D)
$$C_6H_5——CH_3$$
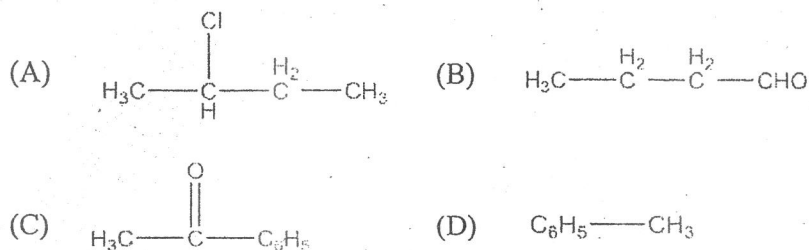
48. An organic compound of molecular formula C_8H_8O gave two strong peaks at m/z=77 and 43 in mass spectrum. The structure of the compound is

(A) [benzene ring with CHO and H₃C substituents, para]

(B) [benzene ring with CHO and CH₃ substituents, ortho]

(C) [benzene ring with C=O—CH₃ (acetophenone)]

(D) [benzene ring fused with oxetane-type ring, CH₂—O—CH₂]
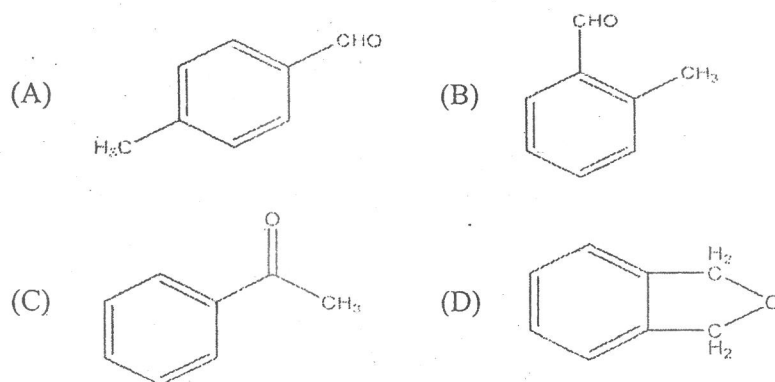
49. Number of $C_6H_3ClBrNO_2$ isomers formed by the bromination of meta-chloronitrobenzene is

(A) 1   (B) 2

(C) 3   (D) 4

50. Which is the best reagent for the following conversation?
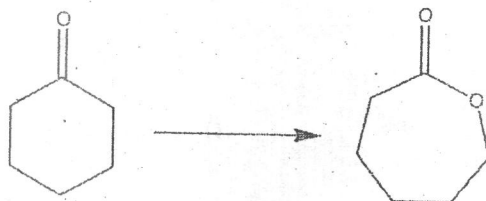
(A) $H_2O_2/\overset{\oplus}{H}$

(B) CH_3CO_3H

(C) CF_3CO_3H

(D) $PhCO_3H$

51. Example of a symmetric rotor

(A) NH_3

(B) SF_6

(C) CO_2

(D) H_2O

52. The unit of partition function is

(A) s^{-1}

(B) dimensionless

(C) $lit\,mol^{-1}$

(D) $J\,K^{-1}$

53. Pick out the Boson

(A) Electron

(B) Proton

(C) Photon

(D) Neutron

54. Essential symmetries of a triclinic system is

(A) None

(B) One C_2 axis

(C) One C_6 axis

(D) One C_3 axis

55. The joule (J) is defined as

(A) $1 J = 1 kg m^2 s^{-2}$
(B) $1 J = 1 kg m^2$
(C) $1 J = 1 kg m^2 s^{-1}$
(D) $1 J = mol\ lit^{-1} s^{-1}$

56. Number of modes of vibration for a CO_2 molecule is

(A) 3
(B) 4
(C) 2
(D) 12

57. Number of components in aqueous acetic acid system is

(A) 1
(B) 2
(C) 3
(D) 0

58. Ionic strength of $1.00\ m\ mol\ kg^{-1}\ CaCl_2$ (aq) at 25°C is

(A) $3\ m\ mol\ kg^{-1}$
(B) $6\ m\ mol\ kg^{-1}$
(C) $2\ m\ mol\ kg^{-1}$
(D) $1\ m\ mol\ kg^{-1}$

59. The term 'nanotechnology' was first used by

(A) Richard
(B) Boltzmann
(C) Kelvin
(D) Nario Taniguchi

60. Level of the atmosphere occurring at the highest altitude is

(A) Mesosphere
(B) Ozone
(C) Statosphere
(D) Trotosphere

61. The cell parameters of a triclinic system are

(A) $a \neq b \neq c; \alpha \neq \beta \neq \gamma = 90°$
(B) $a \neq b = c; \alpha = \beta = \gamma$
(C) $a \neq b \neq c; \alpha \neq \beta = \gamma$
(D) $a \neq b = c; \alpha = \beta \neq \gamma$

62. The standard deviation is

    (A) the square root of the variance
    (B) a measure of the variability
    (C) an approximate indicator of how numbers vary from the mean
    (D) All of the above

63. Choose the n-type semiconductor

    (A) Arsenic doped with germanium
    (B) Germanium doped with silicon
    (C) Iridium doped with germanium
    (D) Boron doped with iridium antimonide

64. Which of the following atom has the high ability to scatter X-rays?

    (A) Cd   (B) Co
    (C) O   (D) Na

65. Number of significant figures in 0.0405 is

    (A) 4   (B) 3
    (C) 5   (D) 1

66. An equilateral triangle belongs to the point group

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

67. Which one of the following molecules will show a microwave rotational spectrum?

    (A) HCl   (B) H_2
    (C) CH_4 (D) SF_6

68. Example of a nonlinear operator

   (A) d/dx   (B) $\sqrt{}$
   (C) d^2/dx^2 (D) x^2

69. Symmetry number of NH_3 molecule is

   (A) 2   (B) 3
   (C) 12   (D) 1

70. IR inactive molecule

   (A) N_2 (B) CO_2
   (C) C_6H_6 (D) OCS

71. $1H_Z$ is equal to

   (A) 1 cm^{-1} (B) 1 s
   (C) 1 m^{-1} (D) 1 s^{-1}

72. First line in the rotational spectrum of Co is 3.842 cm^{-1}. The rotational constant is equal to

   (A) 1.921 m^{-1} (B) 19.21 cm^{-1}
   (C) 1.281 cm^{-1} (D) 1.921 cm^{-1}

73. Specific selection rule of microwave spectroscopy

   (A) $\Delta J = \pm 1$ (B) $\Delta J = 0$
   (C) $\Delta J = \pm 1, \pm 2, \pm 3 \ldots$ (D) $\Delta J = -1$

74. 1 Debye, D is equal to

   (A) $3.3564 \times 10^{-30} \text{ cm}$ (B) $6.623 \times 10^{23} \text{ cm s}^{-1}$
   (C) 8.314 J   (D) 273 K

75. Ionic strength of an uni-univalent electrolyte is equal to

(A) 2 m
(C) Molarity

(B) 0
(D) 1

76. If the momentum of the baseball is 5.6 kg m s^{-1}, the de Broglie wavelength is equal to

(A) 1.2×10^{-34} m
(C) 8.1×10^{12} J

(B) 6.626×10^{-34} m
(D) 5.0×10^{23} s^{-1}

77. Energy of a photon of wavelength 600 nm (red) is equal to

(A) 199 J
(C) 3.31×10^{-19} J

(B) 199×10^{-23} J
(D) 3.31×10^{-34} J

78. Electronic configuration of Ni^{2+} is

(A) [Ar] $3d^8$
(C) [Kr] $3d^4$

(B) [Ne] $3p^1$
(D) [Ar] $3d^1$

79. Which of the following is called a primitive unit cell?

(A) Lattice points at the corners and on two opposite faces
(B) Lattice points at the corner and centre
(C) Lattice points only at the corner
(D) Lattice points on each face

80. Bond order for He$_2$ is

(A) One
(C) Zero

(B) Two
(D) Four

81. Number of mirror planes in an H$_2$O molecule is

(A) 2
(C) 0

(B) 1
(D) 4

82. Which of the following molecules belongs to the point group D_{6h} ?

    (A) C_6H_6

    (B) H_2O

    (C) XeF_4

    (D) SO_3

83. Number of ways of arranging four distinguishable objects into two groups, containing three objects and one object is

    (A) 4

    (B) 2

    (C) 3

    (D) 9

84. Dipole moment of CCl_4 is

    (A) 1.85 D

    (B) 1.08 D

    (C) 0.0 D

    (D) 0.42 D

85. Root mean square speed of the molecule in a gas at a temperature T is

    (A) $(3RT)^{1/2}$

    (B) $(RTM)^{1/2}$

    (C) $(3RT/M)^{1/2}$

    (D) $\sqrt{1/2RT}$

86. Arrange the following ions in order of increasing ionic mobilities in water at 298 K: H^+, Na^+, K^+, Zn^{2+} (μ is the ionic mobility)

    (A) $\mu_{Na^+} < \mu_{Zn^{2+}} < \mu_{K^+} < \mu_{H^+}$

    (B) $\mu_{H^+} < \mu_{Zn^{2+}} < \mu_{K^+} < \mu_{Na^+}$

    (C) $\mu_{Na^+} < \mu_{K^+} < \mu_{H^+} < \mu_{Zn^{2+}}$

    (D) $\mu_{Na^+} < \mu_{Zn^{2+}} < \mu_{H^+} < \mu_{K^+}$

87. .... is used as a catalyst in hydrogenation of oil.

    (A) Al_2O_3

    (B) MgO

    (C) EDTA

    (D) Ni

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88. Charge on a proton is

    (A) 1.6022×10^{-19} c
    (B) 16.023×10^{-23} c
    (C) 3×10^{-8} c
    (D) 6.034×10^{-34} c

89. Boltzmann constant is

    (A) gas constant per molecule
    (B) gas constant
    (C) gas constant × Avogadro's number
    (D) Avogadro's number

90. Reduced mass, μ is equal to

    (A) $m_1 - m_2$
    (B) $m_1 m_2$
    (C) $m_1 m_2 / m_1 + m_2$
    (D) m_2 / m_1

91. Natural rubber is a

    (A) hydrocarbon
    (B) polymer of isoprene
    (C) crosslinked polyethylene
    (D) poly (methyl methacrylate)

92. Zero-point energy of a harmonic oscillator is equal to

    (A) zero

    (B) $\frac{1}{2} h\nu$

    (C) $h\nu$

    (D) one

    (where ν is the frequency of oscillation)

93. The determinant of the matrix $M = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ is equal to

    (A) -2
    (B) 2
    (C) 10
    (D) 0

94. Which of the following molecules may be polar?
ClF_3, O_3, H_2O_2, CO_2

    (A) all the four   (B) none of the above

    (C) CO_2 (D) ClF_3, O_3 and H_2O_2 only

95. How does the total pressure vary during the gas-phase reaction
$2\,ICl(g) + H_2(g) \rightarrow I_2(g) + 2\,HCl(g)$ in a constant volume container?

    (A) No change in pressure
    (B) Pressure increases
    (C) Pressure decreases
    (D) Pressure increases first and then decreases gradually

96. Which one of the following statements is false?

    (A) The coordination number of an ion is the number of nearest neighbours of opposite charge
    (B) The electrical conductivity of a metallic solid decreases with increasing temperature
    (C) Very fast reactions can be studied by flash photolysis
    (D) Half-life of a first order reaction depends on its initial concentration

97. At constant temperature and pressure, a spontaneous process requires

    (A) $\Delta G < 0$ (B) $\Delta G > 0$

    (C) $\Delta G = 0$ (D) $\Delta G = \Delta H$

98. A reaction has an equilibrium constant of 10^{-4}; it means that

    (A) 50% product is formed at equilibrium
    (B) the reaction is highly unfavourable and the product formed is negligible
    (C) the reaction is highly favourable and will have mostly the product at equilibrium
    (D) the amount of product formed cannot be related to the equilibrium constant

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99. The experimental density of sodium chloride crystal is 2.165×10^3 kg m^{-3} while its X-ray density is 2.178×10^3 kg m^{-3}. The fraction of the unoccupied sites in sodium chloride crystal is

    (A) 5.97
    (B) 5.97×10^{-1}
    (C) 5.97×10^{-2}
    (D) 5.97×10^{-3}

100. Speed of a projectile of mass 1.0 g is known to within 1 μm s^{-1}. The minimum uncertainty in position is equal to

    (A) 5×10^{-26} m
    (B) 510 m
    (C) 10×10^{-26} m
    (D) 2.5×10^{-26} m

101. The first four ionization energies of an element are 284, 410, 656 and 3210 kJ/mol respectively. The number of valence electrons present in the element is

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

102. The correct order of the second ionization energies of C, N, O and F is

    (A) $C > N > O > F$
    (B) $F > N > O > C$
    (C) $O > F > N > C$
    (D) $O > N > F > C$

103. The boiling point of H_2O is 100°C while that of H_2Se is −42°C. This can be explained on the basis of

    (A) ionic bonding
    (B) covalent bonding
    (C) hydrogen bonding
    (D) van der Waals forces

104. The radii of hydrated ions increases in the order

    (A) $Rb^+ > K^+ > Na^+ > Li^+$
    (B) $Li^+ > Na^+ > K^+ > Rb^+$
    (C) $Na^+ > K^+ > Rb^+ > Li^+$
    (D) $Rb^+ > Na^+ > K^+ > Li^+$

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105. Which one of the following properties is not the characteristic of alkali metals?

(A) Low I E
(B) Low electro negativity
(C) Outermost ns^1 electronic configuration
(D) Low atomic volume

106. According to the VSEPR theory, the structures of PF_5 and BrF_5 are respectively

(A) TBP and SP
(B) SP and TBP
(C) TBP and TBP
(D) SP and SP

107. The number of lone pairs present in the molecules, BF_3, PF_3, ClF_3 respectively are

(A) 0, 1 and 3
(B) 0, 1 and 2
(C) 0, 0 and 1
(D) 0, 2 and 2

108. The hybridisations and the geometries of XeF_4 and SF_4 are respectively,

(A) sp^3d^2, octahedral and sp^3, tetrahedral
(B) sp^3d^2, square planar and sp^2d, square planar
(C) sp^3d^2, square planar and sp^3, tetrahedral
(D) sp^3d^2, square planar and sp^3d, seesaw

109. The common isotopes of carbon are ^{12}C and ^{13}C. The average mass of carbon is 12.01115 amu. What is the abundance of the ^{13}C isotope?

(A) 1.115%
(B) 98.885%
(C) 0.480%
(D) 2.23%

110. What do the following have in common?

^{20}Ne, $^{19}F^-$, $^{24}Mg^{2+}$
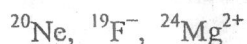
(A) They are isotopes of each other

(B) They are isomers of each other

(C) They are isoelectronic species

(D) They do not have anything in common

111. Which of the following electron configurations represents the Cr atom and Cr^{2+} cation respectively?

(A) $[Ar]4s^2 3d^4$; $[Ar]4s^2 3d^2$ (B) $[Ar]4s^1 3d^5$; $[Ar]4s^1 3d^3$

(C) $[Ar]4s^1 3d^5$; $[Ar]4s^0 3d^4$ (D) $[Ar]4s^1 3d^5$; $[Ar]4s^2 3d^2$

112. The half-life of francium-212 is 19 minutes. How many minutes will it take for 1 g of this isotope to decay to 0.125 g?

(A) 4.75 minutes   (B) 57 minutes

(C) 9.5 minutes   (D) 38 minutes

113. The atom formed by the beta decay of carbon-14 is

(A) ^{18}O (B) ^{14}N

(C) ^{10}B (D) ^{14}B

114. The isoelectronic species among the following is

(A) N_2 and NO   (B) N_2 and CN^-

(C) O_2 and CO   (D) O_2 and NO

115. The correct order of polarity of the bond, shown as dash, is

    (A)   H-F > H-OH > H-SH > H-NH$_2$

    (B)   H-F > H-OH > H-NH$_2$ > H-SH

    (C)   H-OH > H-F > H-NH$_2$ > H-SH

    (D)   H-F > H-NH$_2$ > H-OH > H-SH

116. The number of bonding and non-bonding pairs of electrons present in the central atom of BrF_5 is

    (A)   1 and 5   (B)   5 and 1

    (C)   5 and 16   (D)   5 and 3

117. Which among the following compounds would have optical isomers?

    I.   cis-[Co(en)$_2$Cl$_2$]$^+$ II.   trans-[Co(en)$_2$Cl$_2$]$^+$

    III. [Pt(NH$_3$)$_2$Cl$_2$]   IV. [Ni(CO)$_2$(PPh$_3$)$_2$]

    (A)   Both I and II   (B)   Both I and III

    (C)   All the four   (D)   I only

118. Identify the untrue statement among the following.

    (A)   [CoF$_6$]$^{3-}$: octahedral and paramagnetic

    (B)   [NiCl$_4$]$^{2-}$: square planar and diamagnetic

    (C)   [Ni(CN)$_4$]$^{2-}$: square planar and diamagnetic

    (D)   [CuCl$_4$]$^{2-}$: square planar and paramagnetic

119. The order of increasing covalency among Li$_2$O, LiF and Li$_3$N is

    (A)   LIF < Li$_2$O < Li$_3$N   (B)   Li$_2$O < Li$_3$N < LIF

    (C)   Li$_3$N < LIF < Li$_2$O   (D)   Li$_2$O < LIF < Li$_3$N

120. The increasing order of magnetic moments of

I. $[Fe(CN)_6]^{4-}$ II. $[Fe(CN)_6]^{3-}$

III. $[CrCl_6]^{3-}$ IV. $Ni(H_2O)_6]^{2+}$

is

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

121. For a transition metal ion having eight electrons in its d-orbitals, the effective magnetic moment will be

   (A) $\sqrt{18}$ B.M   (B) $\sqrt{8}$ B.M

   (C) $\sqrt{9}$ B.M   (D) $\sqrt{10}$ B.M

122. Which of the following gas is most abundant in air?

   (A) He   (B) Ne
   (C) Ar   (D) Kr

123. The alloy of copper and zinc is

   (A) Bronze   (B) Solder
   (C) Bell metal   (D) Brass

124. Which of the following transmutations entails an absorption of an alpha particle and release of a proton?

   (A) $^{238}_{92}U \rightarrow ^{234}_{90}Th$ (B) $^{14}_{7}N \rightarrow ^{17}_{8}O$

   (C) $^{238}_{92}U \rightarrow ^{234}_{90}Pa$ (D) $^{27}_{13}U \rightarrow ^{30}_{15}P$

125. Which of the following species has the highest bond order?

    (A) NO^{2-} (B) NO^-

    (C) NO^+ (D) NO^{2+}

126. According to the 18 electron rule, which of the following is not the correct formula of a stable metal carbonyl?

    (A) $[V(CO)_6]^-$ (B) $[Mn(CO)_5]^-$

    (C) $[Fe(CO)_4]^{2-}$ (D) $[Co(CO)_4]$

127. Of the following metal ions, which has the largest magnetic moment in its low spin octahedral complexes?

    (A) Cr^{2+} (B) Mn^{2+}

    (C) Fe^{3+} (D) Fe^{2+}

128. Ziegler Natta catalyst for polymerization of ethylene consists of $TiCl_3$ and

    (A) an aluminum alkyl   (B) acetalylacetonate

    (C) gold cluster   (D) triphenylphosphine

129. Which of the following ligands forms complexes that are examples of linkage isomers?

    (A) en   (B) NO_2^-

    (C) PF_3 (D) SO_4^{2-}

130. Which of the following is the strongest oxidizing agent?

    (A) O_2^+ (B) O_2

    (C) O_2^- (D) O_2^{2-}

131. Ortho and para hydrogens have

    (A) different masses
    (B) different atomic numbers
    (C) nuclei spinning in different ways
    (D) electrons spinning in different directions

132. The smallest cation among Na^+, Mg^{2+}, Al^{3+} and K^+ is

    (A) Na^+ (B) Mg^{2+}
    (C) Al^{3+} (D) K^+

133. Which of the following represents a set of isoelectronic ions?

    (A) Cl^-, K^+, Ca^{2+}, S^{2-} (B) Cl^-, K^+, Ca^{2+}, Sc^{3+}
    (C) Na^+, Li^+, Mg^{2+}, Al^{3+} (D) N^{3-}, F^-, O^{2-}, S^{2-}

134. Crystal field stabilization energy is

    (A) $-4Dq$ for $[FeF_6]^{3-}$

    (B) $-24Dq+2P$ for $[Co(NH_3)_6]^{3+}$

    (C) $-20Dq+3P$ for $[Fe(CN)_6]^{3-}$

    (D) $-8Dq$ for $[Cr(NH_3)_6]^{3+}$

135. A crystal having the lattice parameters $a = b \neq c$ and $\alpha = \beta = 90°$ is

    (A) monoclinic   (B) hexagonal
    (C) orthorhombic   (D) triclinic

136. [NiCl$_2$(PPh$_3$)] is tetrahedral. The analogous compounds of Pd^{II} is square planar. The number of isomers for the two complexes are respectively

    (A) 1 and 1   (B) 2 and 2

    (C) 1 and 2   (D) 2 and 1

137. The Lewis acid character of BF$_3$, BCl$_3$ and BBr$_3$ follows the order

    (A) $BrF_3 < BCl_3 < BF_3$ (B) $BF_3 < BBr_3 < BCl_3$

    (C) $BCl_3 < BF_3 < BBr_3$ (D) $BF_3 < BCl_3 < BBr_3$

138. In the titration of acetic acid with sodium hydroxide, the pH of the solution at the equivalence point is

    (A) about 5   (B) about 8

    (C) about 7   (D) about 6

139. Ni^{2+} can have two unpaired electrons in

    (A) octahedral geometry only

    (B) square planar geometry only

    (C) tetrahedral geometry only

    (D) both tetrahedral and octahedral geometry

140. In molecules H$_2$O, NH$_3$ and CH$_4$

    (A) the bond angles are same

    (B) the bond distances are same

    (C) the hybridizations are same

    (D) the shapes are same

141. The species ^{19}Ne and ^{14}C emit a positron and β particle respectively. The resulting species formed are

(A) ^{19}Na and ^{14}B   (B) ^{19}F and ^{14}N

(C) ^{19}Na and ^{14}N   (D) ^{19}F and ^{14}B

142. Using the weighted-average atomic mass of Li as 6.941u determine the natural abundance of lithium-6 (The mass of lithium-6 is 6.01513u and lithium-7 is 7.01601u)

(A) 7.5%   (B) 92.5%

(C) 15%   (D) 20%

143. In which of the following, the magic numbers of both protons and neutrons are present?

(A) $_{50}Sn^{123}$ (B) $_{82}Pb^{208}$

(C) $_{82}Pb^{206}$ (D) $_{50}Sn^{118}$

144. Hydrogen bomb is based on

(A) nuclear fusion   (B) nuclear fission

(C) nuclear explosion   (D) nuclear spallation

145. A suspension containing insoluble substances ZnS, CuS, HgS, Ag$_2$S and FeS is treated with 2N HCl. On filtering, appreciable amounts of which one of the following groups will be in the filtrate?

(A) Zn and Hg   (B) Ag and Fe

(C) Cu and Hg   (D) Zn and Fe

146. Which of the following complexes will form maximum number of ions in solution?

    (A) $K_3\left[Co(NO_2)_6\right]$ (B) $K_4\left[Fe(CN)_6\right]$

    (C) $\left[Co(NH_3)_6\right]Cl_3$ (D) $\left[Co(NH_3)_3Cl_3\right]$

147. Haematite is concentrated by

    (A)   gravity separation   (B)   froth floatation

    (C)   magnetic separation   (D)   distillation

148. Froth floatation is normally employed for concentration of

    (A)   oxide ores   (B)   carbonate ores

    (C)   chloride ores   (D)   sulphide ores

149. Colour of the solution of sodium metal in liquid ammonia is

    (A)   red   (B)   violet

    (C)   blue   (D)   colourless

150. The suitable indicator in the titration of sodium hydroxide and acetic acid is

    (A)   Methyl orange   (B)   Eriochrome-T

    (C)   Phenolphthalein   (D)   Methyl red

***

SPACE FOR ROUGH WORK