1. The lattice energy of ionic solids is

   (A) directly proportional to inter ionic distance

   (B) inversely proportional to inter ionic distance

   (C) directly proportional to the square of the inter ionic distance

   (D) inversely proportional to the square of the inter ionic distance

2. The names Allred and Rochow are associated with

   (A) Electronegativity   (B) Electron affinity

   (C) Ionization potential   (D) Lattice energy

3. The ionic mobility of alkali metal ions in aqueous solutions follows the order

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

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

4. Which one of the following statements is **not true**?

   (A) Be salts are extensively hydrolyzed

   (B) Be forms Be_2C, which yields methane on hydrolysis

   (C) Be is basic like the other metals of its group

   (D) $Be(OH)_2$ is amphoteric

5. The order of Lewis acidity of boron halides is

   (A) $BF_3 > BCl_3 > BBr_3 > BI_3$ (B) $BI_3 > BBr_3 > BCl_3 > BF_3$

   (C) $BCl_3 > BF_3 > BBr_3 > BI_3$ (D) $BBr_3 > BI_3 > BCl_3 > BF_3$

6. Hydrolysis of CaC_2 gives

   (A) CH_4 (B) C_2H_2

   (C) CH_3COOH (D) CH_3CH_2OH

7. Triple superphosphate is

   (A) $B(H_2PO_4)_3$ (B) $Al(H_2PO_4)_3$

   (C) $Ca(H_2PO_4)_2$ (D) K_3PO_4

8. PbO is

   (A) a base   (B) an acid

   (C) a salt   (D) an amphoteric substance

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9. Cl_2 can be prepared in laboratory by

   (A) treating $MgCl_2$ with $NaOH$ (B) treating MnO_2 with HCl

   (C) treating $NaCl$ with H_2SO_4 (D) treating $NaCl$ with H_3PO_4

10. What is calculated spin only magnetic moment of Fe^{2+}?

   (A) 3.87 BM   (B) 2.83 BM

   (C) 4.90 BM   (D) 5.92 BM

11. In which of the following complexes Fe is **not** present?

   (A) Ferredoxins   (B) Cytochromes

   (C) Vitamin B_{12} (D) Hemoglobin

12. Which one of the following is an important component of Ziegler-Natta catalyst?

   (A) $TiCl_3$ (B) $FeCl_3$

   (C) $PtCl_4$ (D) $MnCl_2$

13. $[Re_2Cl_8]^{2-}$ contains

   (A) an Re-Re single bond   (B) an Re-Re double bond

   (C) an Re-Re triple bond   (D) an Re-Re quadruple bond

14. The color of $KMnO_4$ is due to

   (A) $d-d$ transitions

   (B) charge transfer

   (C) the formation of $[K(H_2O)_6]^+$ in solution

   (D) the formation of $[Mn(H_2O)_6]^{2+}$ in solution

15. The ground state free ion term symbol for Fe(III) ion is

   (A) $^2P_2$ (B) $^2D_2$ (C) $^6S_{5/2}$ (D) $^6F_{5/2}$

16. The IUPAC nomenclature of $Li[AlH_4]$ is

   (A) lithium tetrahydridoaluminum (III)

   (B) tetrahydridoaluminum (III) lithium

   (C) lithium tetrahydridoaluminate (III)

   (D) lithium tetrahydridoaluminate (IV)

17. CFSE of high-spin Fe(III) in octahedral field is

   (A) $0.4 \Delta_o$ (B) $2.4 \Delta_o$ (C) $0 \Delta_o$ (D) $1.8 \Delta_o$

18. Which of the following terms refers to a material which slows neutrons?

    (A)   retarder   (B)   moderator

    (C)   buffer   (D)   diffractor

19. For which of the following classes of salts are all of its compounds soluble in water?

    (A)   Chlorides   (B)   Sulfates

    (C)   Hydroxides   (D)   Nitrates

20. Δ_o (in coordination complexes) **does not** depend upon

    (A)   geometry around the central metal ion   (B)   atomic weight of the metal ion

    (C)   nature of the metal ion   (D)   oxidation state of the metal ion

21. Structure of ClF_3 is

    (A)   Trigonal planar

    (B)   Trigonal pyramidal

    (C)   T – shaped

    (D)   Octahedral with three lone pairs occupying a face

22. Structure of $XeOF_4$ is

    (A)   square pyramidal   (B)   tetrahedral

    (C)   planar   (D)   trigonal bipyramidal

23. IUPAC nomenclature of the complex $[CoCl_2(CN)(NH_3)_3]$ is

    (A)   cyanodichlorotriamminecobalt (III)

    (B)   dichlorocyanotriamminecobalt (III)

    (C)   cyanotriamminecobalt (III) chloride

    (D)   triamminedichlorocyanocobalt (III)

24. Which one of the following compounds is pyrophoric (catches fire when exposed to air)?

    (A) $SiMe_3$ (B) NMe_3 (C) CMe_3 (D) PMe_3

25. Which one of the following compounds has larger dipole moment?

    (A) NH_3 (B) NF_3 (C) BCl_3 (D) CCl_4

26. The conjugate base of $[H_2PO_4]^-$ is

    (A) $[PO_4]^{3-}$ (B) $[HPO_4]^{2-}$ (C) H_3PO_4 (D) $[H_3P_2O_7]^-$

27. "Zn(II) complexes are atypical of d-block complexes in general." Which answer below is correct and supports this statement?

   (A) Zn(II) complexes are paramagnetic

   (B) Zn(II) complexes tend to be colourless

   (C) Zn(II) complexes are always octahedral

   (D) Zn(II) is one of several oxidation states of Zn

28. How many isomers are there of octahedral $[CrCl_2(H_2O)_4]^+$ and tetrahedral $[NiCl_2(py)_2]^+$?

   (A) 2 for $[CrCl_2(H_2O)_4]^+$; 2 for $[NiCl_2(py)_2]^+$

   (B) 2 for $[CrCl_2(H_2O)_4]^+$; 1 for $[NiCl_2(py)_2]^+$

   (C) 3 for $[CrCl_2(H_2O)_4]^+$; 1 for $[NiCl_2(py)_2]^+$

   (D) 3 for $[CrCl_2(H_2O)_4]^+$; 2 for $[NiCl_2(py)_2]^+$

29. The number of radial nodes possessed by a $4f$ atomic orbital is

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

30. In which of the following is the metal reduced? (These are not balanced equations).

   (A) $[Fe(CN)_6]^{4-} \rightarrow [Fe(CN)_6]^{3-}$ (B) $[MnO_4]^- \rightarrow MnO_2$

   (C) $[MnO_4]^{2-} \rightarrow [MnO_4]^-$ (D) $[Cr_2O_7]^{2-} \rightarrow [CrO_4]^{2-}$

31. IUPAC name for

   HO⌒⌒⌒COOEt is

   (A) ethyl 6-hydroxyhexanoate   (B) ethyl 1-hydroxy-6-hexanoate

   (C) 5-Ethoxycarbonyl-1-pentanol   (D) 1-Ethoxycarbonyl-5-pentanol

32. In the stable conformation of ethylene glycol dihedral angle in degrees would be

   (A) 0   (B) 60   (C) 120   (D) 180

33. In TLC (SiO_2) the order of R_T in 9:1 hexane: ethylacetate would be

   i. anthracene   ii. β – napthol   iii. Octane

   (A) iii > i > ii   (B) i > iii > ii   (C) ii > i > iii   (D) i > ii > iii

34. The reaction of phenylmagnesium bromide with acetylene provides

   (A) 1-phenylacetylene   (B) 1,2-diphenylacetylene

   (C) ethylene   (D) benzene

35. Which one of the following compounds readily dissolves in aqueous 0.1 N Na_2CO_3?

(A) α – Naphthol

(B) Pyrene

(C) 2,4-Dinitrophenol

(D) 1-Octanol

36. The order of reactivity of the following olefins with HBr is

i.   cyclohexene

ii.   1-methyl-1-cyclohexene

iii. 3,3-dimethyl-1-cyclohexene

(A) ii > iii > i   (B) ii > i > iii   (C) iii > ii > i   (D) iii > i > ii

37. Of the four compounds namely i. styrene, ii phenylacetic acid, iii. aniline and iv. benzamide reduction with H_2/ PtO_2 can be achieved easily for

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

38. Nitration of β – napthol provides

(A) 1-nitro-2-hydroxynapthalene

(B) 3-nitro-2-hydroxynapthalene

(C) 4-nitro-2-hydroxynapthalene

(D) 5-nitro-2-hydroxynapthalene

39. Rate of the reactivities of the following allotropes of carbon

i. diamond   ii. Fullerenes   iii. Graphite

(A) i > ii > iii   (B) i > iii > ii   (C) ii > i > iii   (D) ii > iii > i

40. Elemental analysis of an organic compound revealed C: 40%, H: 60% and MW = 90. Number of double bonds and (or) rings in the molecules is

(A) one   (B) two   (C) three   (D) four

41. Cyclohexanol was heated with H_2SO_4 at 150° C to generate product **X** which on treatment with m-chloroperbenzoic acid provided **Y**. **X** and **Y** are

(A) cyclohexene and epoxycyclohexane

(B) cyclohexanone and 1,2-dihydroxycyclohexane

(C) 1,3-cyclohexadiene and benzene

(D) dicyclohexyl ether and cyclohexene

42. When cyclohexyl methanol was heated with H_2SO_4 one of the product is

(A) 1-methyl-1-cyclohexene

(B) 2-methylcyclohexanone

(C) cycloheptene

(D) 1-ethyl-1-cyclopentene

43. Correct bond length of carbon-carbon double bond in ethylene is

    (A) 120 pm   (B) 134 pm   (C) 154 pm   (D) 168 pm

44. The ^{1}H NMR spectrum of an organic compound of MF: C_4H_9Br exhibited a single line. The compound could be

    (A) 1-bromobutane   (B) 2-bromobutane

    (C) 1-bromo-2-methylpropane   (D) 2-bromo-2-methylpropane

45. Kolbe's electrolysis of sodium butanoate provides

    (A) propane   (B) butane   (C) hexane   (D) octane

46. Reaction of 1-hexene with HCl is expected to provide

    (A) 1-chlorohexane   (B) 2-chlorohexane

    (C) 3-chlorohexane   (D) 2,2-dichlorohexane

47. Reaction of 1-butyne with $NaNH_2$ followed by reaction with 1-bromobutane provides

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

48. The reaction of acetophenone with iodine and NaOH provides

    (A) benzaldehyde and iodoform   (B) benzoic acid and acetic acid

    (C) benzyl alcohol and sodium iodate   (D) sodium benzoate and iodoform

49. 2-Butanol reacts with $SOCl_2$, pyridine to provide mainly

    (A) 1-butene   (B) 2-butene

    (C) di-butyl ether   (D) 1,2-dichlorobutane

50. Reaction of butyl lithium with ethyl formate provides

    (A) 1-butanol   (B) 5-nonanol   (C) 3-nonanol   (D) 1-nonanol

51. The reaction of Z-3-hexene with i. OsO_4, ii. H_3O+ provides

    (A) 3-hexanes   (B) *erythro*-3,4-dihydroxyhexane

    (C) *threo*-3,4-dihydroxyhexane   (D) *meso*-3,4-dihydroxyhexane

52. Configuration at C2 and C3 in the following compound is

$$
\begin{array}{c}
\text{COOH} \\
\text{HO} - \!\!\!\!- \text{H} \\
\text{D} - \!\!\!\!- \text{H} \\
\text{COOH}
\end{array}
$$
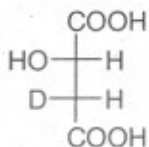
    (A) *R,R*   (B) *R,S*   (C) *S,R*   (D) *S,S*

53. Reactive intermediate in the following conversion is

$$HO-\underset{\triangle}{\overset{}{C}}=\xrightarrow{\ H_2SO_4\ }$$ (cyclobutanone with CH₃)
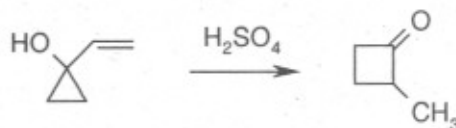
(A) cyclopropyl carbocation   (B) secondary carbocation

(C) carbanion   (D) free radical

54. Which one of the following is a good diene?

(A) 1,3-butadiene   (B) 1,2-butadiene

(C) 2,4-hexadiene   (D) furan

55. 4-Bromotoluene was reacted with i. Mg ii. D_2O. Product of the reaction is

(A) benzyl alcohol   (B) 4-deuterobenzyl alcohol

(C) 4-methylphenol   (D) 4-deuterotoluene

56. When glycerol is treated with conc. HNO_3 and H_2SO_4, it gets converted to

(A) nitroethane   (B) 1-nitropropane

(C) nitroglycerine   (D) 2-nitropropane

57. Silver acetate reacts with Br_2 to form methylbromide, carbondioxide and AgBr. This reaction is an example of

(A) Wurtz reaction   (B) Etard reaction

(C) Hunsdiecker reaction   (D) Perkin reaction

58. Butanoic acid was treated sequentially with i. $SOCl_2$ ii. $AlCl_3$ iii. benzene. The product formed was

(A) 1-phenyl-1-butanone   (B) 1-phenyl-2-butanone

(C) 3-phenyl-2-butanone   (D) 4-phenyl-1-butanol

59. Natural fats are

(A) monoesters of glycerol   (B) diesters of glycerol

(C) triesters of glycerol   (D) diesters of glycol

60. The product formed on heating hydrazobenzene with *dil.* H_2SO_4 is

(A) diazonium salt   (B) aniline

(C) benzidine   (D) 1,4-diaminobenzene

61. Representing solvent and solute in a binary solution by subscripts 1 and 2, respectively, the conversion expression for molarity in to molality is

(A) $m = \dfrac{M}{\rho - MM_2}$

(B) $m = \dfrac{mM_1}{\rho + MM_2}$

(C) $m = \dfrac{\rho - MM_2}{M}$

(D) $m = \dfrac{1 + \rho M_1}{M_2}$

62. A solution containing sodium hydroxide and sodium carbonate is titrated against 0.1 M HCl using methyl orange indicator. At the equivalence point

(A) both sodium hydroxide and sodium carbonate are completely neutralized

(B) only sodium hydroxide is completely neutralized

(C) only sodium carbonate is completely neutralized

(D) sodium hydroxide completely and sodium carbonate completely converted to sodium bicarbonate

63. The expression of most probable speed of molecules of a gas is given as

(A) $\sqrt{\dfrac{2RT}{M}}$

(B) $\sqrt{\dfrac{3RT}{M}}$

(C) $\sqrt{\dfrac{8RT}{\pi M}}$

(D) $\sqrt{\dfrac{8RT}{M}}$

64. A gas undergoing expansion through a porous plug exhibits neither heating nor cooling if its temperature is equal to

(A) Boyle temperature

(B) Critical temperature

(C) Inversion temperature

(D) Consolute temperature

65. Which of the following statements is NOT correct?

(A) Viscosity of ethanol is smaller than that of glycol

(B) Viscosity of a liquid increases with impurities

(C) The variation of viscosity is given by $\gamma = A \exp(-E/RT)$

(D) Capillary action is due to surface tension of a liquid

66. If the anions (A) from hexagonal closest packing and cations (C) occupy only 2/3 octahedral voids in it, then the general of the compound is

(A) CA

(B) CA_2

(C) C_2A_3

(D) C_3A_2

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(A) CA

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(D) C_3A_2

9 369

67. In a Rock-salt structure, with edge length = a, which of the following expressions is correct?

(A) $r_a = \sqrt{2}a$ (B) $r_a = a/2$ (C) $r_a = a/2\sqrt{2}$ (D) $r_a = \sqrt{3}\,a/2$

68. A 4 : 1 mixture of He and CH_4 is contained in a vessel at 20 bar pressure. Due to a hole in the vessel gas mixture leaks out. The composition of the mixture, effusing out initially is about

(A) He : CH_4 :: 1 : 1   (B) He : CH_4 :: 2 : 1

(C) He : CH_4 :: 4 : 1   (D) He : CH_4 :: 8 : 1

69. The expression of velocity of an electron in a Bohr orbit of a hydrogen-like species is

(A) $v = \dfrac{2\pi\left(Ze^2 / 4\pi\varepsilon_0\right)}{nh}$ (B) $v = \dfrac{2\pi nh}{\left(Ze^2 / 4\pi\varepsilon_0\right)}$

(C) $v = \dfrac{nh}{2\pi\left(Ze^2 / 4\pi\varepsilon_0\right)}$ (D) $v = \dfrac{\left(Ze^2 / 4\pi\varepsilon_0\right)}{2\pi nh}$

70. Which of the following species will produce the shortest wavelength for the transition n = 2 to n = 1?

(A) Hydrogen atom   (B) Singly ionized helium atom

(C) Deuterium atom   (D) Doubly ionized lithium atom

71. For 2s orbital of hydrogen atom, the nodal surface exists at a distance

(A) a_0 from the nucleus   (B) $2a_0$ from the nucleus

(C) $2.5a_0$ from the nucleus   (D) $4.0a_0$ from the nucleus

72. For a linear triatomic gas, the value of the ratio of heat capacities is

(A) 5/3   (B) 7/5   (C) 9/7   (D) 15/13

73. Which of the following statements regarding the entropy is NOT correct?

(A) S(monoclinic) > S(rhombic)   (B) C(diamond) > C(graphite)

(C) $H_2O(g)$ > $H_2O(l)$ (D) $O_3(g)$ > $O_2(g)$

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74. For the reaction $2NO(g) = N_2(g) + O_2(g)$, the enthalpy change is -180 kJ/mol. Which of the following facts does not hold good?

(A) The pressure changes at constant temperature do not affect the equilibrium constant

(B) The volume changes at constant temperature do not affect the equilibrium constant

(C) The dissociation of NO is favoured less at high temperature

(D) The dissociation of NO is favoured more at high temperature

75. The equilibrium constant K_c of the reaction $A_2(g) + B_2(g) = 2AB(g)$ is 50. If 1 mol of A_2 and 2 mol of B_2 are mixed, the amount of AB at equilibrium would be

(A) 0.467 mol

(B) 0.934 mol

(C) 1.401 mol

(D) 1.866 mol

76. One mole of $N_2O_4(g)$ at 300 K is kept in a closed container under one atmosphere. It is heated to 600 K when 20% by mass of $N_2O_4(g)$ decomposes to $NO_2(g)$. The resultant pressure is

(A) 1.2 atm

(B) 2.4 atm

(C) 2.0 atm

(D) 1.0 atm

77. The number of H^+ ions present in 1 mL of a solution having pH = 13 is

(A) 6.023×10^{23}

(B) 6.023×10^{13}

(C) 6.023×10^7

(D) 6.023×10^{10}

78. The time required to coat a metal surface of 80 cm^2 with 5×10^{-3} cm thick layer of silver (density of silver is 10.5 g/cm^3) with the passage of 3 A current through a silver nitrate solution is

(A) 1150 s

(B) 1250 s

(C) 1350 s

(D) 1450 s

79. The unit of molar conductivity is

(A) Ω^{-1}

(B) $\Omega^{-1}cm^{-1}$

(C) $\Omega^{-1}cm^{-1}mol^{-1}$

(D) $\Omega^{-1}cm^2mol^{-1}$

80. For the electrochemical cell $M \mid M^+X^- \mid\mid X^- \mid X$, E^0 $(M^+/M) = 0.44$ V and $E_0(X/X^-) = 0.33$ V. From this data one can deduce that

(A) oxidation of M and reduction of X are spontaneous reaction

(B) reduction of M^+ and oxidation of X^- are spontaneous

(C) cell potential = 0.77 V

(D) cell potential = $- 0.77$ V

81. The time taken to decompose electrolytically 18 g water by 2A current is about

(A) 24.8 h (B) 26.8 h

(C) 28.8 h (D) 30.8 h

82. Which of the following plot correctly represents the behavior of an ideal binary liquid solution?

(A) Plot of x_A versus y_A is linear (B) Plot of x_A versus y_B is linear

(C) Plot of $1/X_A$ versus $1/y_A$ is linear (D) Plot of $1/x_A$ versus $1/y_B$ is linear

83. Raoult's law is obeyed by each constituent of a binary liquid solution when

(A) the forces of attractions between like molecules are greater than those between unlike molecules

(B) the forces of attractions between like molecules are smaller than those between unlike molecules

(C) the forces of attractions between like molecules are more or less identical with those of unlike molecules

(D) the volume occupied by unlike molecules are different

84. For a first-order reaction, the plot of log $[A]_t$ versus t is linear with a

(A) positive slope and zero intercept

(B) positive slope and nonzero intercept

(C) negative slope and zero intercept

(D) negative slope and nonzero intercept

85. Which of the following statements is NOT correct?

(A) A colloidal solution is a heterogeneous two-phase system

(B) Silver sol in water is an example of lyophilic sol

(C) Metal hydroxides in water are examples of lyophobic sol

(D) Liquid-liquid colloidal solution is not stable system

86. The number of EPR hyperfine lines expected for methyl radical are

(A) two

(B) three

(C) four

(D) none

87. Nuclear quadrupolar effect is due to

(A) electron spin value equal to zero

(B) nuclear spin value equal to zero

(C) electron spin value greater than 1/2

(D) nuclear spin value greater than ½

88. For a molecule to be Raman active, the condition is

(A) change in dipole moment

(B) change in electron spin value

(C) change in polarizability

(D) change in nuclear spin value

89. The number of normal modes of vibration for water and carbon dioxide are

(A) 3 and 4

(B) 4 and 3

(C) 3 and 3

(D) 4 and 4

90. In a system, $a = b = c$; $\alpha = \beta = \gamma \neq 90$ degrees, then it belongs to

(A) cubic

(B) triclinic

(C) monoclinic

(D) rhombohedral

91. If the radius of Ist Bohr's orbit is a0 then the radius of 3rd Bohr's orbit is

(A) 3a0

(B) 6a0

(C) 9a0

(D) 19a0

92. The spiliting of spectral lines under the influence of magnetic field is known as

(A) Staric effect

(B) Zeeman effect

(C) Photoelectric effect

(D) Crompton effect

93. In hydrogen spectrum, the series of lines appearing in visible region are known as

(A) Lyman

(B) Paschen

(C) P fund

(D) Balmer

94. Azimuthal quantum number determines the

    (A) spin   (B) angular momentum of orbitals

    (C) size   (D) orientation

95. The spectrum of He^+ is expected to be similar to that of

    (A) Hydrogen atom   (B) He

    (C) Li^+ (D) Li

96. 1 ev energy is equivalent to a photon with a wavelength about

    (A) 30000 Å   (B) 3000 Å

    (C) 12000 Å   (D) 1200 Å

97. Among the following, conjugate pair of variable is

    (A) momentum and energy   (B) potential energy and position

    (C) linear momentum and distance   (D) time and energy

98. The maximum extent of hydrogen bonding is shown by

    (A) H_2O (B) HF

    (C) H_2Se (D) H_2S

99. Which of the following property does not have any unit?

    (A) Ionisation potential   (B) Electronegativity

    (C) Atomic radii   (D) Electron affinity

100. Among the following radiations, the largest frequency is of

    (A) radio wave   (B) micro wave

    (C) X-rays   (D) IR