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COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2010

Serial No. ____

CHEMISTRY
Code No. 04

A

Time Allowed : Two Hours | ***Maximum Marks : 300***

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ROUGH WORK

1. Larger number of oxidation states are exhibited by the actinoids than those by the lanthanoids, the main reason being :
   (A) 4f orbitals more diffused than the 5f orbitals
   (B) lesser energy difference between 5f and 6d than between 4f and 5d orbitals
   (C) more energy difference between 5f and 6d than between 4f and 5d orbitals
   (D) more reactive nature of the actinoids than the lanthanoids

2. Which one of the following is the correct statement ?
   (A) Boric acid is a protonic acid
   (B) Beryllium exhibits coordination number of six
   (C) Chlorides of both beryllium and aluminium have bridged chloride structures in solid phase
   (D) $B_2H_6.2NH_3$ is known as 'inorganic benzene'

3. Among the following substituted silanes the one which will give rise to cross linked silicone polymer on hydrolysis is :
   (A) R_4Si (B) $RSiCl_3$
   (C) R_2SiCl_2 (D) R_3SiCl

4. In a compound atoms of element Y from ccp lattice and those of element X occupy 2/3rd of tetrahedral voids. The formula of the compound will be :
   (A) X_4Y_3 (B) X_2Y_3
   (C) X_2Y (D) X_3Y_4

5. Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$ solution in the presence of H_2SO_4. The titration gives unsatisfactory result when carried out in the presence of HCl, because HCl :
   (A) gets oxidised by oxalic acid to chlorine
   (B) furnishes H^+ ions in addition to those from oxalic acid
   (C) reduces permanganate to Mn^{2+}
   (D) oxidises oxalic acid to carbon dioxide and water

6. Which one of the following pairs of species have the same bond order ?
   (A) CN^- and NO^+ (B) CN^- and CN^+
   (C) O^- and CN^- (D) NO^+ and CN^+

7. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]Cl_2$ is :
   (A) nitrito-N-pentaamminecobalt (III) chloride
   (B) nitrito-N-pentaamminecobalt (II) chloride
   (C) pentaammine nitrito-N-cobalt (II) chloride
   (D) pentaammine nitrito-N-cobalt (III) chloride

8. A metal, M forms chlorides in its +2 and +4 oxidation states. Which of the following statements about these chlorides is correct ?
   (A) MCl_2 is more volatile than MCl_4
   (B) MCl_2 is more soluble in anhydrous ethanol than MCl_4
   (C) MCl_2 is more ionic than MCl_4
   (D) MCl_2 is more easily hydrolysed than MCl_4

9. Which of the following statements is true ?
   (A) H_3PO_3 is a stronger acid than H_2SO_3
   (B) In aqueous medium HF is a stronger acid than HCl
   (C) $HClO_4$ is a weaker acid than $HClO_3$
   (D) HNO_3 is a stronger acid than HNO_2

10. Which one of the following sets of ions represents a collection of isoelectronic species ?
   (A) $K^+, Cl^-, Ca^{2+}, Sc^{3+}$ (B) $Ba^{2+}, Sr^{2+}, K^+, S^{2-}$
   (C) $N^{3-}, O^{2-}, F^-, S^{2-}$ (D) $Li^+, Na^+, Mg^{2+}, Ca^{2+}$

11. What products are expected from the disproportionation reaction of hypochlorous acid ?
   (A) $HClO_3$ and Cl_2O (B) $HClO_2$ and $HClO_4$
   (C) HCl and Cl_2O (D) HCl and $HClO_3$

12. In $Fe(CO)_5$, the Fe – C bond possesses :
   (A) p-character only (B) both s and p characters
   (C) ionic character (D) s-character only

13. Lanthanoid contraction is caused due to :
   (A) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
   (B) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge
   (C) the same effective nuclear charge from Ce to Lu
   (D) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge

14. Following statements regarding the periodic trends of chemical reactivity of the alkali metals and the halogens are given. Which of these statements gives the correct picture ?
    (A) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group
    (B) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group
    (C) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens
    (D) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group

15. How many EDTA (ethylenediaminetetraacetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion ?
    (A) Six (B) Three
    (C) One (D) Two

16. Hydrogen bomb is based on the principle of :
    (A) Nuclear fission (B) Natural radioactivity
    (C) Nuclear fusion (D) Artificial radioactivity

17. An ionic compound has a unit cell consisting of A ions at the corners of a cube and B ions on the centres of the faces of the cube. The empirical formula for this compound would be :
    (A) AB (B) A_2B
    (C) AB_3 (D) A_3B

18. During the process of electrolytic refining of copper, some metals present as impurity settle as 'anode mud'. These are :
    (A) Sn and Ag (B) Pb and Zn
    (C) Ag and Au (D) Fe and Ni

19. The molecular shapes of SF_4, CF_4 and XeF_4 are :
    (A) the same with 2, 0 and 1 lone pairs of electrons on the central atom, respectively
    (B) the same with 1, 1 and 1 lone pair of electrons on the central atoms, respectively
    (C) different with 0, 1 and 2 lone pair of electrons on the central atoms, respectively
    (D) different with 1, 0 and 2 lone pairs of electron on the central atoms, respectively

20. The number and type of bonds between two carbon atoms in calcium carbide are

(A) One sigma, one pi
(B) One sigma, two pi
(C) Two sigma, one pi
(D) Two sigma, two pi

21. The number of hydrogen atom(s) attached to phosphorus atom in hypophosphorous acid is :

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

22. Which one of the following ions has the highest value of ionic radius ?

(A) Li^{+}
(B) F^{-}
(C) O^{2-}
(D) B^{3+}

23. The transition metal present in vitamin B_{12} is :

(A) Fe
(B) Ni
(C) Co
(D) Zn

24. How many electrons are involved in the oxidation by $KMnO_4$ in basic medium ?

(A) 1
(B) 2
(C) 3
(D) 5

25. The shape of XeF_2 molecule is :

(A) tetrahedral
(B) pyramidal
(C) trigonal planar
(D) linear

26. During the extraction of Fe, slag obtained is :

(A) FeO
(B) $FeSiO_3$
(C) $MgSiO_3$
(D) $CaSiO_3$

27. The lightest particle is :

(A) electron
(B) proton
(C) neutron
(D) α-particle

28. Which of the following elements does not exhibit allotropy ?

(A) Arsenic
(B) Tin
(C) Silicon
(D) Bromine

29. Which one of the following pairs of elements does not illustrate the diagonal relationship in the Periodic Table ?

(A) Li and Na (B) Li and Mg

(C) Be and Al (D) B and Si

30. Nitric acid converts iodine into :

(A) hydriodic acid (B) iodic acid

(C) hypoiodous acid (D) ammonium iodine

31. Which of the following molecules has highest dipole moment ?

(A) H_2S (B) CO_2

(C) CCl_4 (D) BF_3

32. Ferrocene cannot undergo :

(A) Friedel-Crafts acylation (B) Diels-Alder reaction

(C) oxidation by Ag^+ ion (D) electrophilic reaction

33. $B_{10}C_2H_{12}$ is isoelectronic with :

(A) $B_{12}H_{12}^{2-}$ (B) $B_{12}H_{12}$

(C) $B_{12}H_{12}^{+}$ (D) $B_{12}H_{12}^{2+}$

34. Which of the following does not have a metal-metal bond ?

(A) $K_2Re_2Cl_2$ (B) $Mn_2(CO)_{10}$

(C) Hg_2Cl_2 (D) Al_2Cl_6

35. On heating, zinc oxide becomes yellow and on cooling, becomes white. This shows that it is :

(A) an oxidizing agent (B) a reducing agent

(C) a Lewis acid (D) non-stoichiometric

36. The conjugate base of H_3O^+ is :

(A) H^+ (B) H_2O

(C) H_2O_2 (D) OH^-

37. Of the following isotopes, the one that is not radioactive is :

(A) ^{132}I (B) ^{131}I

(C) ^{40}Ca (D) ^{90}Sr

38. Which of the following is a soft base ?

(A) CH_3COO^- (B) H^-

(C) NO^{3-} (D) CO_3^{2-}

39. Which of the following products is obtained on heating, B_2H_6 with NH_3 in ratio 1 : 3 at higher temperature ?

(A) $B_3N_3H_3$ (B) $B_2H_6.2NH_3$

(C) Boron nitride (D) $B_3N_3H_6$

40. The product obtained by successive emission of an alpha particle and a beta particle from $^{238}U_{92}$ is an isotope of :

(A) radium (B) thorium

(C) lead (D) protactinium

41. Reaction of trans-2-phenyl-1-bromocyclopentane with alcoholic KOH produces :

(A) 4-phenylcyclopentene (B) 2-phenylcyclopentene

(C) 1-phenylcyclopentene (D) 3-phenylcyclopentene

42. Increasing order of stability among the three main conformations (i.e. Eclipse, Anti, Gauche) of 2-fluoroethanol is :

(A) Eclipse, Gauche, Anti (B) Gauche, Eclipse, Anti

(C) Eclipse, Anti, Gauche (D) Anti, Gauche, Eclipse

43. Which of the following is a polyamide ?

(A) Teflon (B) Nylon–66

(C) Terylene (D) Bakelite

44. Which one of the following types of drugs reduces fever ?

(A) Analgesic (B) Antipyretic

(C) Antibiotic (D) Tranquiliser

45. Due to the presence of an unpaired electron, free radicals are :

(A) Chemically reactive (B) Chemically inactive

(C) Anions (D) Cations

46. 2-methylbutane on reacting with bromine in the presence of sunlight gives mainly :
(A) 1– bromo-2- methylbutane (B) 2– bromo-2- methylbutane
(C) 2– bromo-3- methylbutane (D) 1– bromo-3- methylbutane

47. Tertiary alkyl halides are practically inert to substitution by SN^2 mechanism because of :
(A) insolubility (B) instability
(C) inductive effect (D) steric hindrance

48. Reaction of one molecule of HBr with one molecule of 1, 3-butadiene at 40 Degree C gives predominantly :
(A) 3-bromobutene under kinetically controlled conditions
(B) 1-bromo-2-butene under thermodynamically controlled conditions
(C) 3-bromobutene under thermodynamically controlled conditions
(D) 1-bromo-2-butene under kinetically controlled conditions

49. Among the following acids which has the lowest pKa value ?
(A) CH_3COOH (B) HCOOH
(C) $(CH_3)_2COOH$ (D) CH_3CH_2COOH

50. Fehling's solution and Benedict's solutions are reduced by glucose to form :
(A) CuO (B) Cu_2O
(C) $Cu(OH)_2$ (D) $Cu(CO)_4$

51. Which of the following is fully fluorinated polymer ?
(A) Neoprene (B) Teflon
(C) Thiokol (D) PVC

52. Two moles of acetone under the influence of sodium hydroxide will yield :
(A) 4-methyl-2-pentanone (B) 4-hydroxy-2-pentanol
(C) 4-methyl-2-pentanoic acid (D) 4-hydroxy-4-methyl-2-pentanone

53. Which of the following bonds would show the strongest absorption in the IR ?
(A) carbon-hydrogen (B) oxygen-hydrogen
(C) nitrogen-hydrogen (D) sulfur-hydrogen

54. Alkyl halides react with dialkyl copper reagents to give :
(A) alkenes (B) alkyl copper halides
(C) alkanes (D) alkenyl halides

55. Amongst the following the most basic compound is :
(A) benzylamine (B) aniline
(C) acetanilide (D) p-nitroaniline

56. Which types of isomerism is shown by 2, 3-dichlorobutane ?
(A) Diastereo (B) Optical
(C) Geometric (D) Structural

57. In a low resolution NMR spectrum of ethanol, the area under the peak corresponding to OH, CH_2 and CH_3 protons respectively will be in the ratio :
(A) 1 : 2 : 3 (B) 3 : 2 : 1
(C) 1 : 3 : 2 (D) 3 : 1 : 2

58. In "nitration mixture" concentrated sulphuric acid is used as :
(A) sulphonating agent (B) dehydrating agent
(C) for the formation of nitronium ions (D) for the formation of nitrate ions

59. The pyrimidine bases present in DNA are :
(A) cytosine and adenine (B) cytosine and guanine
(C) cytosine and thymine (D) cytosine and uracil

60. The term anomers of glucose refers to :
(A) isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)
(B) a mixture of (D)-glucose and (L)-glucose
(C) enantiomers of glucose
(D) isomers of glucose that differ in configuration at carbon one (C-1)

61. Phenyl magnesium bromide reacts with methanol to give :
(A) a mixture of anisole and Mg(OH)Br (B) a mixture of benzene and Mg(OMe)Br
(C) a mixture of toluene and Mg(OH)Br (D) a mixture of phenol and Mg(Me)Br

62. The number of unshared electrons on the carbene carbon is :

(A) 1 (B) 2

(C) 3 (D) 4

63. The simplest amino acid is :

(A) cystine (B) alanine

(C) glycine (D) hoistidine

64. Acid anhydrides add to aromatic aldehydes in the presence of a base yield :

(A) α, β- unsaturated acids (B) esters

(C) β, γ-unsaturated acids (D) alcohols

65. Transition between the excited singlet and triplet states are :

(A) spin allowed (B) spin forbidden

(C) very frequent (D) not observed

66. The stability of the cycloalkanes, as shown by the temperature at which the rings are broken by catalytic hydrogenation, is least for which of the following ?

(A) Cyclopropane (B) Cyclobutane

(C) Cyclopentane (D) Cyclohexane

67. The reactive intermediate involved in the conversion of phenol to salicylaldehyde using chloroform and sodium hydroxide :

(A) Cl_2C : (B) Cl_2CH^+

(C) Cl_2CH^- (D) Cl_2C^+

68. Wolf-Kishner reduction is applied to one of the following functional groups :

(A) >C=O (B) >C=C<

(C) –C≡C– (D) –C≡N

69. The number of ^1H NMR spectrum 3, 5-dibromotoluene is :

(A) 3 (B) 4

(C) 2 (D) 6

70. Among the following the strongest electrophile is :

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

(C) RN^{2+} (D) H_3O^+

71. The heterocyclic compound, which exhibits tautomerism, is :

(A) pyrazole (B) indole

(C) pyrrole (D) thiophen

72. The enzyme, which acts on starch, is :

(A) amylase (B) esterase

(C) protease (D) urease

73. Which of the following is least reactive towards bromine ?

(A) anisole (B) chlorobenzene

(C) nitrobenzene (D) phenol

74. Raman spectrum is due to :

(A) absorption of energy by molecules (B) emission energy by molecules

(C) inelastic collisions (D) absorption and re-emission

75. The Markovnikoff Rule is used in connection with :

(A) stereochemistry of elimination reactions

(B) stability of free radicals

(C) activity of enzymes

(D) addition of acids to double bonds

76. To detect gas leakage from cylinders the substance added to LPG is :

(A) Phenols (B) Thioalcohols

(C) Glycols (D) Glycine

77. In the Fischer projection formula, meso-2, 3-butanediol is in :

(A) a staggered conformation (B) an eclipsed conformation

(C) a gauche conformation (D) an anticlinal conformation

78. Essential oils are :

(A) Mixtures of various hydrocarbons
(B) Mixtures of higher fatty acids
(C) Mixtures of aldehydes
(D) Pleasant smelling liquids occurring in plants

79. Which of the following is not glycerides ?

(A) Fat
(B) Phospholipid
(C) Soaps
(D) Oils

80. Proteins do not respond to :

(A) Lucas test
(B) Biuret test
(C) Ninhydrin test
(D) Haller's ring test

81. A reaction was found to be second order with respect to the concentration of carbon monoxide. If the concentration of carbon monoxide is doubled, with everything else kept the same, the rate of reaction will :

(A) remain unchanged
(B) triple
(C) increase by a factor of 4
(D) double

82. In Langmuir's model of adsorption of a gas on a solid surface :

(A) the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
(B) the adsorption at a single site on the surface may involve multiple molecules at the same time
(C) the mass of gas striking a given area of surface is proportional to the pressure of the gas
(D) the mass of gas striking a given area of surface is independent of the pressure of the gas

83. Rate of a reaction can be expressed by Arrhenius equation as :
$k = Ae^{-E/RT}$ (where E/RT is read as power of e) in this equation, E represents

(A) the energy above which all the colliding molecules will react
(B) the energy below which colliding molecules will not react
(C) the total energy of the reacting molecules at a temperature, T
(D) the fraction of molecules with energy greater than the activation energy of the reaction

84. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is :

(A) 1.14 mol kg^{-1}
(B) 3.28 mol kg^{-1}
(C) 2.28 mol kg^{-1}
(D) 0.44 mol kg^{-1}

85. 18 g of glucose ($C_6H_{12}O_6$) is added to 178.2 g of water. The vapour pressure of water for this aqueous solution at 100°C is :
(A) 759.00 Torr
(B) 7.60 Torr
(C) 76.00 Torr
(D) 752.40 Torr

86. If a is the degree of dissociation of Na_2SO_4, the Vant Hoff's factor (i) used for calculating the molecular mass is :
(A) 1 + a
(B) 1 – a
(C) 1 + 2a
(D) 1 – 2a

87. Which one of the following statements is NOT true about the effect of an increase in temperature on the distribution of molecular speeds in a gas ?
(A) The most probable speed increases
(B) The fraction of the molecules with the most probable speed increases
(C) The distribution becomes broader
(D) The area under the distribution curve remains the same as under the lower temperature

88. Two solutions of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5 M first solution + 520 mL of 1.2 M second solution. What is the molarity of the final mixture ?
(A) 1.20 M
(B) 1.50 M
(C) 1.344 M
(D) 2.70 M

89. A reaction involving two different reactants can never be :
(A) Unimolecular reaction
(B) First order reaction
(C) Second order reaction
(D) Bimolecular reaction

90. The disperse phase in colloidal iron (III) hydroxide and colloidal gold is positively and negatively charged, respectively, which of the following statements is NOT correct ?
(A) magnesium chloride solution coagulates, the gold sol more readily than the iron (III) hydroxide sol.
(B) sodium sulphate solution causes coagulation in both sols
(C) mixing the sols has no effect
(D) coagulation in both sols can be brought about by electrophoresis

91. For an isochoric process :
(A) Volume is constant
(B) Pressure is constant
(C) Internal energy is constant
(D) Temperature is constant

92. The protective colloid can convert :
(A) Irreversible colloid into a reversible colloid
(B) Reversible colloid into irreversible colloid
(C) Lyophobic colloid into lyophilic colloid
(D) Lyophilic colloid into lyophobic colloid

93. Which is readily adsorbed by activated charcoal ?
(A) Cl_2 (B) CO_2
(C) H_2 (D) SO_2

94. Adsorption plays an important role in :
(A) Heterogeneous catalysis (B) Homogeneous catalysis
(C) Positive catalysts (D) Negative catalysts

95. LeChatelier principle is applicable only to :
(A) Homogeneous reaction (B) Heterogeneous reaction
(C) Systems in equilibrium (D) Systems not in equilibrium

96. For a zero order reaction, the plot of concentration vs time is linear with :
(A) Positive slope and zero intercept (B) Negative slope and zero intercept
(C) Positive slope and non-zero intercept (D) Negative slope and non-zero intercept

97. The approximate voltage of dry cell is :
(A) 2.0 V (B) 1.2 V
(C) 6.0 V (D) 1.5 V

98. During an isothermal expansion of an ideal gas, its :
(A) Internal energy increases (B) Enthalpy decreases
(C) Enthalpy remains unaffected (D) None

99. Which law of thermodynamics introduce the concept of entropy ?
(A) First law (B) Second law
(C) Zeroth law (D) Third law

100. A buffer solution of sodium acetate and acetic acid is diluted with water. Its pH will :
(A) Increase (B) Decrease
(C) Remains same (D) None

101. Indicator used in the titration of $KMnO_4$ against Fe^{2+} ion is :

(A) Methyl red (B) Self indicator

(C) Phenolphthalein (D) Methyl orange

102. Which of the following is used as contact catalyst ?

(A) Nickel (B) Germanium

(C) Boron (D) Uranium

103. The kinetics of enzyme catalyst was suggested by :

(A) Henery (B) Briggs

(C) Langmuir (D) Ostwald

104. Electrochemical equivalent of a substance is 0.0006735. Its equivalent weight is :

(A) 65 (B) 67.35

(C) 130 (D) 260

105. Milk is an example of :

(A) Emulsion (B) Suspension

(C) Gel (D) True solution

106. Which of the following is not a colligative property ?

(A) Lowering of vapour pressure (B) Elevation of boiling point

(C) Boiling point (D) Depression of freezing point

107. In an ideal gas, Joule-Thomson effect is :

(A) Positive (B) Negative

(C) Infinite (D) Zero

108. Which of the following gas would have highest root mean square (RMS) velocity at 25°C ?

(A) CO (B) CO_2

(C) SO_2 (D) O_2

109. The highest number of molecules are in :

(A) 2 g of H_2 (B) 2 g of N_2

(C) 16 g of O_2 (D) 16 g of CO_2

110. Gold number indicates :

(A) Protective action of lyophilic colloid (B) Protective action of lyophobic colloid

(C) Amount of gold in a given solution (D) Charge on gold solution

111. Total no of variables defining a system of C components with P phases is :

(A) C(P–1) (B) 3

(C) C + P + 2 (D) C–P + 2

112. The collision theory is satisfactory for _____ reactions :

(A) zero order (B) unimolecular

(C) bimolecular (D) any order

113. The inversion temperature (T_i) for a van der Waals gas is equal to :

(A) 2a/Rb (B) a/2Rb

(C) a/Rb (D) ab/2R

114. The units of the rate and rate constant are the same for reaction of order :

(A) 0 (B) 1

(C) ½ (D) 2

115. At the boiling point of an azeotropic mixture, the number of degrees of freedom is :

(A) zero (B) 1 at constant pressure

(C) zero at constant pressure (D) two

116. The Onsager equation helps us to find out :

(A) dissociation constant of a weak electrolyte

(B) λ_0 for a weak electrolyte

(C) transport number of an ion

(D) λ_0 of a strong electrolyte

117. The triple point for water is :

(A) unique (B) depends on p but is independent of T

(C) depends on T but is independent of p (D) depends on p and T

118. Catalyst used for the hydrogenation of vegetable oils is :

(A) Cu
(B) Finely divided Ni
(C) Al_2O_3
(D) Pt-black

119. The free energy $\Delta G = 0$, when :

(A) The system at equilibrium
(B) Catalyst is added
(C) Reactants are initially mixed thoroughly
(D) Reactants are completely consumed

120. 50% of the amount of a radioactive substance decomposes in 5 years. The time required for the decomposition of 99.9% of the substance will be :

(A) 10 years
(B) 25 years
(C) 75 years
(D) 50 years

ROUGH WORK

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