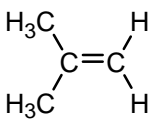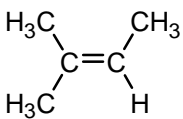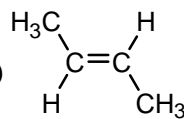# CAREER ENDEAVOUR
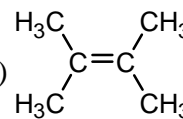## Best Institute for IIT-JAM, NET & GATE
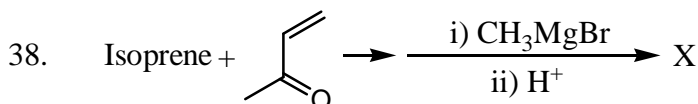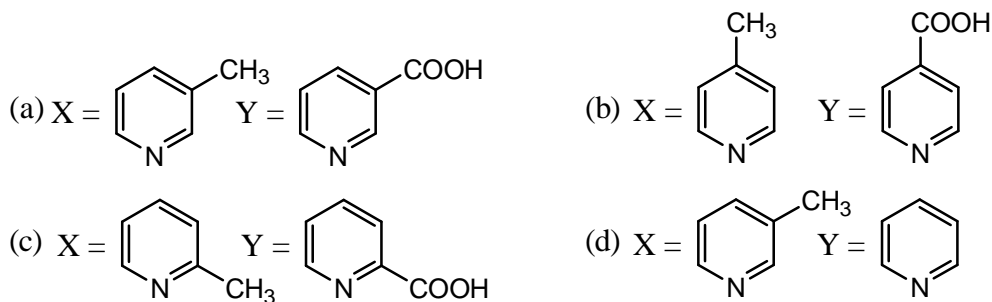
B.H.U.-2017 : CHEMISTRY

1. The half life of radium is 1600 years. After how much time will 1 gm radium reduced to 125 mgs.
   (a) 1800 years   (b) 1600 years   (c) 3200 years   (d) 4800 years

2. The energy can be represented in terms of partition function by the following equation:

   (a) $E = kT \left(\partial \ln Q / \partial T \right)_v$

   (b) $E = kT^2 \left(\partial \ln Q / \partial T \right)_v$

   (c) $E = k/T \left(\partial \ln Q / \partial T \right)_v$

   (d) $E = k/T^2 \left(\partial \ln Q / \partial T \right)_v$

3. The Variation theorem used to find the MO wave function ψ is a/an :
   (a) Exact method   (b) Approximate method
   (c) Magnetic method   (d) Spectroscopic method

4. According to Bose-Einstein statistics the maximum probability distribution is:

   (a) $n_i / g = 1 / e^{\alpha + \beta \varepsilon 1}$ (b) $n_i / g = 1/e^{\alpha + \beta \varepsilon 1} - 1$ (c) $n_i / g = 1/e^{\alpha + \beta \varepsilon 1} + 1$ (d) None of these

5. The concept of Excess Functions is applicable to:
   (a) Non-ideal solution   (b) Ideal solutions   (c) Phase equilibrium   (d) Exact differentials

6. Canonical Ensembles are:
   (a) Isolated systems   (b) Closed isothermal systems
   (c) Open isothermal systems   (d) Imaginary systems

7. Which of the following partition functions will be substantially larger than unity?
   (a) Electronic   (b) Vibrational   (c) Rotational   (d) Translational

8. In Fermi-Dirac statistics the particles are:
   (a) Indistinguishable   (b) Distinguishable   (c) Adsorbed   (d) Absorbed

9. The entropy production for a system having two fluxes J_1 and J_2 is given by $\sigma = J_1 X_1 + J_2 X_2$, here X_1 and X_2 stand for _____ corresponding to J_1 and J_2.
   (a) Mole fractions   (b) Forces
   (c) Molar concentrations   (d) Chemical potentials

10. The Ilkovic equation is:

    (a) $I_d = 607 \, n \, D^{1/2} m^{2/3} t^{1/2} c$

    (b) $I_d = 706 \, n \, D^{3/2} m^{2/3} t^{1/2} c$

    (c) $I_d = 607 \, n \, D^{2/3} m^{1/2} t^{1/3} c$

    (d) $I_d = 706 \, n \, D^{1/3} m^{2/3} t^{1/2} c$

11. In any crystal ratio of Weiss indices of the face is 2:4:3, then Miller indices would be:
    (a) 634   (b) 346   (c) 436   (d) 643

12. The number of atoms per unit cell in simple cubic fcc and bcc are:
    (a) 4, 2, 1   (b) 1, 2, 4   (c) 1, 4, 2   (d) 2, 4, 1

13. If velocity constant of a reaction is 2.0×10^{-4} sec and rate of reaction is 8.0×10^{-4} mole^{-1} litre^{-1} sec^{-1}, then concentration of reactant will be:

(a) 8.0×10^{-4} mole^{-1} litre^{-1}

(b) 1.0 mole^{-1} litre^{-1}

(c) 4.0 mole^{-1} litre^{-1}

(d) 8.0 mole^{-1} litre^{-1}

14. On increasing the temperature the rate of reaction is doubled per 10 °C. If the temperature is increased by 50 °C, then the rate of reaction will increase :

(a) 12 times   (b) 16 times   (c) 32 times   (d) 50 times

15. If the entropy change $dS_{UV} > 0$ (where U = internal energy and V = volume) then the process would be:

(a) Spontaneous   (b) Reversible   (c) Exothermic   (d) None of the above

16. The correct form of Clausius-Clapeyron equation is :

(a) $dP/dT = \Delta H/T\Delta V$

(b) $dV/dT = \Delta H/T\Delta V$

(c) $dT/dP = \Delta H/V\Delta T$

(d) $dP/dT = L/T(P_2 - P_1)$

17. On increasing the temperature the rate of reaction is doubled per 10 °C. If the temperature is increased by 50 °C, then the rate of reaction will increase :

(a) 12 times   (b) 16 times   (c) 32 times   (d) 50 times

18. Which of the following is true for an orthorhombic lattice?

(a) $a = b = c, \alpha = \beta = \gamma = 90°$

(b) $a \neq b \neq c, \alpha = \beta = \gamma = 90°$

(c) $a \neq b \neq c, \alpha = \gamma = 90°, \beta \neq 90°$

(d) $a = b \neq c, \alpha = \beta = \gamma$

19. Which of the following is the correct order of surface area per molecule/Nm² for Langmuir-Blodgett films?
(a) steric acid > tri-para cresyl phosphate > iso steric acid
(b) tri-para cresyl phosphate > iso steric acid > steric acid
(c) iso steric acid > tri-para cresyl phosphate > steric acid
(d) steric acid > iso steric acid > tri-para cresyl phosphate

20. Cu-Ni alloy is an example of :
(a) Substitutional solid solution
(b) Interstitial solid solution
(c) Mixture
(d) None of these

21. Which of the following refractive material has highest melting point?

(a) Al_2O_3 (b) SrO   (c) MgO   (d) HfC

22. Which of the following alkenes would have the largest λ_{max} ?

23. The correct order of IR stretching frequencies for $C \equiv C, C = C$ and $C - C$ bond is :

(a) $C - C > C = C > C \equiv C$

(b) $C \equiv C > C = C > C - C$

(c) $C - C > C = C < C \equiv C$

(d) $C = C < C - C > C \equiv C$

24. Which is correct for Lambert's and Beer's law?

(a) $\log I_0/I = -\varepsilon\, Cl$ (b) $\log I_0/I = \varepsilon\, Cl$ (c) $\log I/I_0 = \varepsilon\, Cl$ (d) None of these

Where I = intensity of transmitted light, I_0 = intensity of incident light, C = concentration, l = path length and ε = molar absorptivity.

25. The vibrational degrees of freedom for $CH_2 = CHCH_2Br, CO_2$ and SO_2 are :

(a) 22, 3, 4   (b) 21, 4, 3   (c) 22, 4, 3   (d) 21, 3, 4

26. The τ values of methyl protons in methyl halides are in the order :

(a) $CH_3F > CH_3Cl > CH_3Br > CH_3I$ (b) $CH_3Cl > CH_3F > CH_3Br > CH_3I$

(c) $CH_3I > CH_3Br > CH_3Cl > CH_3F$ (d) $CH_3I < CH_3Br > CH_3F > CH_3Cl$

27. If mass of the particle = m and length of a one dimensional box = L, the energy of a particle is by :

(a) $nh/8\ mL^2$ (b) $n^2h^2/8\ mL^2$ (c) $nh/8\ \pi mL^2$ (d) $n^2h^2/8\ mL$

28. A solution containing one mole for litre each of $Cu(NO_3)_2$, $AgNO_3$, $Hg_2(NO_3)_2$ and $Mg(NO_3)_2$ is electrolyzed using inert electrodes.
Standard electrode potentials in volts (reduction potentials) are :

$Ag^+ \mid Ag = 0.80$

$Hg2^{2+} \mid Hg = 0.79$

$Cu^{2+} \mid Cu = 0.34$

$Mg^{2+} \mid Mg = -2.37$

With increasing voltage, the sequence of deposition of metals on the cathode will be :
(a) Ag, Hg, Cu, Mg (b) Mg, Cu, Hg, Ag (c) Ag, Hg, Cu (d) Cu, Hg, Ag

29. $E°(Cu^{2+}/Cu) = +0.34\ V$. What is the value of E (at 298 K) for an aqueous solution in which $[Cu^{2+}] = 0.02\ mol\ dm^{-3}$?

(a) 0.29 V (b) 0.32 V (c) 0.39 V (d) 0.36 V

30. Which of the following is NOT a property of a catalyst ?
(a) It lowers the activation energy for both the forward and reverse processes.
(b) It increases the rate of both the forward and reverse processes.
(c) It may be recovered unchanged at the end of the reaction.
(d) It increases the equilibrium constant.

31. Which of the following alkene addition reactions occur(s) specifically in an *anti* fashion ?
(a) hydroboration-oxidation (b) addition of Br_2
(c) addition of H_2 (d) addition of H_2O in dilute acid

32. Which statement about cyclohexane is *incorrect* ?
(a) Each C atom is sp^3 hybridized
(b) H atoms occupy equatorial or axial sites
(c) The cyclohexane ring can flip between chair and boat conformers
(d) Cyclohexane suffers ring strain

33. Which one of the following sugar is non-reducing?
(a) Fructose (b) Sucrose (c) Lactose (d) Maltose

34. Epimerization of an aldose sugar involves the difference in stereochemistry at carbon :
(a) C-1 only (b) C-2 only (c) C-3 and C-4 only (d) C-2 or C-3 or C-4 only

35. Which one of the following form the same osazone on the treatment with excess of phenyl hydrazine?
(a) D(+)-Glucose and D(+)-Mannose (b) D(+)-Glucose and D(−)-Galactose
(c) D(+)-Galactose and D(+)-Mannose (d) D(+)-Glucose and D(−)-Ribose

36. Quinoline on reduction leads to the formation of decahydroquinoline using one of the following :
(a) $LiAlH_4$ (b) Na-Liq. NH_3 (c) H_2/Ni (d) H_2, Pt in CH_3COOH

37. $2CH_2 = CHCHO + NH_3 \rightarrow X \xrightarrow{K_2Cr_2O_7, H_2SO_4} Y$ where X and Y are :

(a) $X = $ [3-methylpyridine] $Y = $ [pyridine-3-COOH]

(b) $X = $ [4-methylpyridine] $Y = $ [pyridine-4-COOH]

(c) $X = $ [2-methylpyridine] $Y = $ [pyridine-2-COOH]

(d) $X = $ [3-methylpyridine] $Y = $ [pyridine]

38. Isoprene + [methyl vinyl ketone] $\xrightarrow{\text{i) } CH_3MgBr,\ \text{ii) } H^+}$ X
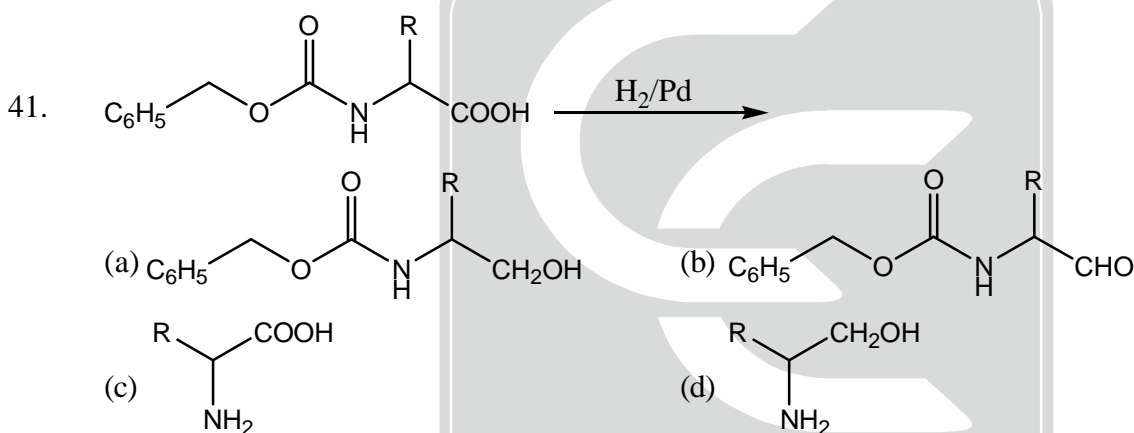
(a) α-terpeniol   (b) Geraniol   (c) Citral   (d) α-pinene

39. Amino acids on treatment with aq. $NaNO_2$ and HCl in cold conditions generates effervescences due to :
(a) Formation of NH_3 (b) Formation of CO_2 (c) Formation of N_2 (d) Formation of Cl_2

40. Sulphur containing amino acid combination is :
(a) Cysteine and Glutamine
(b) Glutamine and Methionine
(c) Cysteine and Methionine
(d) Tryptophan and methionine

41. [C_6H_5 carbamate-amino acid structure] $\xrightarrow{H_2/Pd}$

(a) C_6H_5 [carbamate with CH$_2$OH]

(b) C_6H_5 [carbamate with CHO]

(c) [amino acid R–COOH with NH$_2$]

(d) [R–CH$_2$OH with NH$_2$]

42. Ziegler-Natta catalyst used in polymerization of olefins is :

(a) $Al(CH_3)_3$ and $TiCl_3$
(b) $Al(C_2H_5)_3$ and $TiCl_3$
(c) $Al(C_2H_5)_3$ and $TiCl_4$
(d) $Al(CH_3)_3$ and $TiCl_4$

43. Nylon 66 is condensation polymer of which type and what are its condensing units ?
(a) Polyester, hexamethylene diamine – Adipic acid
(b) Polyamide, hexamethylene diamine – Adipic acid
(c) Polyester, hexamethylene diamine – Sebacic acid
(d) Polyamide, hexamethylene diamine – Sebacic acid

44. Polyurethanes are formed from the reaction of :
(a) Urea and Formaldehyde
(b) Isocyanate and alcohol
(c) Urea and alcohol
(d) isocyanate and Formaldehyde

45. Polymerization unit of Neoprene is :

(a) H_3C [1,3-pentadiene]   (b) Cl [chloro-1,3-butadiene chain]   (c) [isoprene with CH_3]   (d) [chloroprene with Cl]
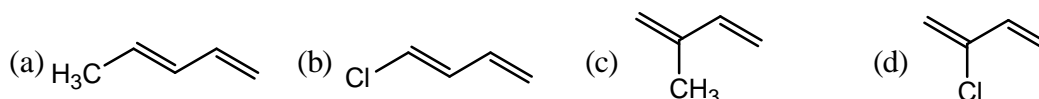
46. Molecular system changes from colourless to coloured on increasing conjugation due to :
    (a) Lower energy $\pi - \pi*$ transition
    (b) Lower energy $\sigma - \sigma*$ transition
    (c) Higher energy $\pi - \pi*$ transition
    (d) Higher energy $\sigma - \sigma*$ transition

47. Phenolphthalein dye is synthesized by the reaction of phthalic anhydride with :
    (a) Resorcinol (b) *p*-Hydroxyphenol (c) *p*-Nitrophenol (d) Phenol

48. Geraniol belongs to which class of terpenoids and how many isoprene units are there in it?
    (a) Diterpene, two units
    (b) Monoterpenes, one unit
    (c) Diterpenes, one unit
    (d) Monoterpenes, two units

49. Pick up the position of methyl and comment on stability.
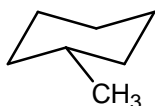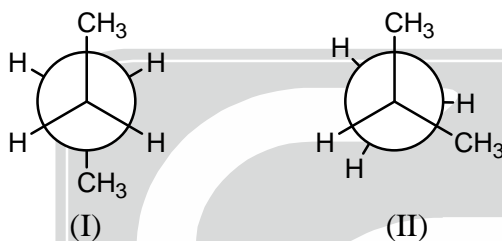

    (a) Equatorial, more stable
    (b) Axial, more stable
    (c) Equatorial, less stable
    (d) Axial, less stable

50. Which of the following is the best explanation for the relative stability of the conformations ?

    (I)   (II)

    (a) (I) has more torsional strain
    (b) (II) has more torsional strain
    (c) (I) has more steric strain
    (d) both have more steric strain

51. In the boat confirmation of cyclohexane, the most destabilizing interaction is :
    (a) Eclipsing (b) 1, 3-diaxial (c) 1, 3-diequatorial (d) flagpole-flagpole

52. Choose the correct order of stability of conformational isomeric forms of cyclohexane :
    (a) chair form > boat form > twist boat form
    (b) chair form > twist boat form > boat form
    (c) boat form > twist boat form > chair form
    (d) twist boat form > boat form > chair form

53. The reactive intermediate involved in the reaction of benzene with diazomethane is :
    (a) Carbocation (b) Carbanion (c) Carbene (d) Free radical

54. Carbene formed as an intermediate in :
    (a) Pinacol-pinacolone Rearrangement
    (b) Hoffmann Rearrangement
    (c) Beckmann Rearrangement
    (d) Wolf Rearrangement

55.
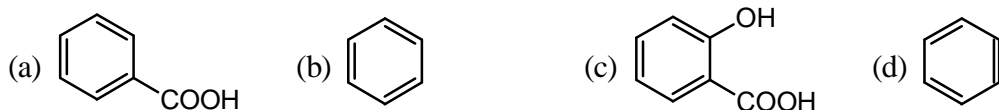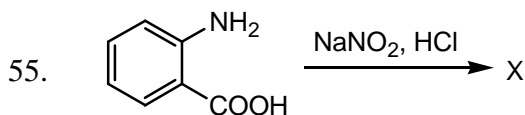
56. Naphthalene on treatment with conc. H_2SO_4 at 160 °C temp. or higher gives mainly :
    (a) α-Naphthalenesulphonic acid
    (b) β-Naphthalenesulphonic acid
    (c) naphthalene-1, 2-disulphonic acid
    (d) Phthalic acid

57. Nicotine on oxidation followed by heating at 460 K gives rise to :
    (a) Pyridine-2-carboxylic acid
    (b) Piperidine-2-carboxylic acid
    (c) Piperidine-3-carboxylic acid
    (d) Pyridine-3-carboxylic acid

58. *n*-Propylbromide on treatment with ethanolic KOH gives :
    (a) Propane   (b) Propene   (c) Propyne   (d) Propanol

59. Aldol condensation between which of the following compounds followed by dehydration give methyl vinyl ketone :
    (a) Formaldehyde and Acetone
    (b) Formaldehyde
    (c) Two molecules of acetaldehyde
    (d) Two molecules of Acetone

60. Hybridization of the singlet and triplet carbenes are :
    (a) sp and sp^2 (b) sp^2 and sp^2 (c) sp^2 and sp (d) sp and sp

61. The Ⓐ model regards lattice energy as determining stabilization-factor of chemical bonding in crystalline solid state. Here Ⓐ is :
    (a) Molecular orbital   (b) Valence bond   (c) Ionic   (d) Covalent

62. Using VSEPR theory, the molecular shapes of the XeF_4, XeO_4, XeF_2 and $XeOF_2$ respectively are :
    (a) Tetrahedral, Square planar, Angular, Triangular
    (b) Sqaure planar, Tetrahedral, Linear, T-shaped
    (c) Tetrahedral, Tetrahedral, Linear, Linear
    (d) Square planar, Square planar, Angular, Linear

63. Assuming strong field ligands, the difference in CFSE in the unit of Δ_0 between the complexes of d^6 (octahedral) and d^6 tetrahedral is :
    (a) $-2.13\,\Delta_0$ (b) $-3.5\,\Delta_0$ (c) $-1.5\,\Delta_0$ (d) $-2.0\,\Delta_0$

64. The defect in a crystal which arises due to a vacancy in an otherwise perfect lattice and in it an atom or ion is missing from its normal site of the lattice is termed as Ⓐ. It is a Ⓑ type of defect.
    Here Ⓐ and Ⓑ respectively are :
    (a) Schottky, Extrinsic point
    (b) Schottky, Intrinsic point
    (c) Frenkel, Intrinsic point
    (d) Frenkel, Extrinsic point

65. The magnetic moment of an octahedral $Co^{2+}\left(d^7\right)$ complex is 4.0 B.M. The crystal field due to ligands around the metal ion is Ⓐ and the total number of electrons in $d_{x^2-y^2}$ and d_{z^2} are Ⓑ. Here Ⓐ and Ⓑ respectively are :
    (a) Strong, Six   (b) Strong, Three   (c) Weak, Six   (d) Weak, Two

66. Two hybrid orbitals of atom A are formed by linearly combining ($4s$ and $3d_{xz}$) orbitals. These are allowed to form two bonds with hydrogen 1s orbitals interaction to form a AH_2 molecule. The shape of the AH_2 molecule will be :
    (a) Linear
    (b) Angular
    (c) Two AH bonds at $120°$ to each other
    (d) Two AH bonds at $140°$ to each other

67. According to M.O. theory, the ground state of H_2 is σ_{1s}^2. In addition to the ground state, there are following excited states of H_2 :

    (1) $\uparrow$ $\uparrow$ (2) $\uparrow$ $\downarrow$ (3) $\bigcirc$ $\uparrow\downarrow$ (4) $\downarrow$ $\uparrow$
    $\quad\sigma_{1s}\ \sigma_{1s}^*$ $\sigma_{1s}\ \sigma_{1s}^*$ $\sigma_1^{1s}\ \sigma_{1s}^*$ $1\sigma_{1s}^b\ 1\sigma_{1s}^*$

The highest and lowest energy states of H_2 will respectively be :

(a) (2) and (1)   (b) (3) and (1)   (c) (1) and (2)   (d) (2) and (3)

68. Out of the following molecules/ions, the ones which are isoelectronic with N_2 and NH_3 respectively are :

(1) CO_3^{2-} (2) Ozone   (3) Oxalate ion   (4) N_3^- (5) $CO(f)H_3O^+$

(a) N_2 with O_3 and NH_3 with N_3^-

(b) N_2 with CO and NH_3 with H_3O^+

(c) N_2 with H_3O^+ and NH_3 with $C_2O_4^{2-}$

(d) N_2 with $C_2O_3^{2-}$ and NH_3 with O_3

69. The value of $\beta\left(\dfrac{B}{B_0}\right)$ of a ligand shows the extent of Ⓐ in the M–L bond of the complex and also the extent of delocalization of ligand electrons. Its value is Ⓑ for the electrons in Ⓒ and Ⓓ orbitals. Since the σ overlap of Ⓓ is usually larger than the Π-orbital overlap of Ⓒ, the cloud expansion is larger in the former case. Here Ⓐ, Ⓑ, Ⓒ and Ⓓ respectively are :

(a) ionicity, higher, t_{2g}, e_g

(b) ionicity, lower, e_g, t_{2g}

(c) covalence, different, t_{2g}, e_g

(d) covalence, higher, e_g, t_{2g}

70. In CsCl ionic solid structure, the coordination number of Cs^+ and Cl^- ions respectively are :

(a) 6 and 8   (b) 8 and 8   (c) 4 and 6   (d) 6 and 4

71. Which one of the following molecules will show optical activity and is a chiral molecule ?

(1) $\left[Cr(C_2O_4)_3\right]^{3-}$ [octahedral]

(2) $Cis-\left[PtCl_2(CN)_2\right]$ square planar

(3) $Cis-\left[RhCl_2(NH_3)_4\right]$ octahedral

(4) $\left[Ru(bipy)_3\right]$ octahedral

The correct alternative out of the following four alternatives is :

(a) All the four molecules are chiral

(b) (1) and (3) are chiral and (2) and (4) are achiral

(c) (1) and (4) are chiral and (2) and (3) are achiral

(d) (1), (2), (3) are chiral and (4) achiral

72. The metal ion is located in the specific regions of the membrane of the cell and has a highly specific roles to play there. One of the roles is to control the distribution of protons and electrons. The ion is :

(a) Zn^{2+} (b) Mg^{2+} (c) Co^{2+} (d) $Fe^{+2/+3}$

73. The transition metal ions (viz, Mn, Fe, Co, Cu) are used in redox enzymes in preference of Zn^{2+}, Ga and Ca^{2+}. The reason is that :

(a) These have spectral bands in the visible region

(b) These have variables valence or oxidation states

(c) These produce a specific magnetic field in the cell

(d) The metal ions are coloured.

74. In transition metal tetrahedral complexes one has lower value of Δ (i.e. $\Delta_t < \Delta_0$). further t_2 and C orbitals are Ⓐ affected by Π-bonding. Although $\Delta_t < \Delta_0$, but the electronic parameter β is Ⓑ affected and thus all tetrahedral complexes are Ⓒ spin.

Here Ⓐ, Ⓑ and Ⓒ respectively are :

(a) equally, the same, high

(b) more, same, high

(c) less, lesser, low

(d) less, more, high

75. In the reactions :

    (1) graphite $+$ K vapours $\rightarrow$ Ⓐ

    (2) carbon $+$ Ca $\xrightarrow[\text{Temp}]{\text{High}}$ Ⓑ

    the products Ⓐ and Ⓑ respectively are

    (a) K_4C and Ca_2C (b) K_2C_2 and CaC (c) KC_8 and CaC_2 (d) KC and CaC_4

76. In methyl lithium $\left[Li(CH_3)\right]_4$ molecule, the bond between Lithium and (CH_3) group is :

    (a) Two center-two electron bond $(2c-2e)$ (b) Three center-two electron bond $(3c-2e)$

    (c) Four center-two electron bond $(4c-2e)$ (d) Five center-two electron bond $(5c-2e)$
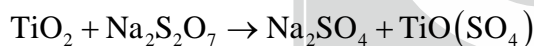
77. In the following list :

    (1) $B(CH_3)_3$ (2) $B(OCH_3)_3$ (3) $SiCl_3(CH_3)$ (4) $\left[N(CH_3)_3\right]$

    (5) $\left[NaCH_3COO\right]$

    the molecules which cannot be classified as organometallics are :

    (a) $B(OCH_3)_3 , Si(Cl_3)(CH_3) , Na(CH_3COO)$

    (b) $N(CH_3)_3 , Na(CH_3COO)$

    (c) $B(OCH_3)_3 , \left[Na(CH_3COO)\right]$

    (d) $\left[Na(CH_3COO)\right] , B(CH_3)_3$

78. The ores of Ti, Ta and Nb may be brought into solution near $800\,°C$ using $Na_2S_2O_7$. A simplified reaction may be as follows :

    $$TiO_2 + Na_2S_2O_7 \rightarrow Na_2SO_4 + TiO(SO_4)$$

    The acid and base in the reaction are :

    (a) Ti^4 as base and Na in Na_2S_2O as acid

    (b) $S_2O_7^{2-}$ as base and O_2 as acid

    (c) O_2^{4-} of TiO_2 (base) and SO_3 in S_2O_7 (acid)

    (d) Ti^{+4} as acid and S^{6+} as acid

79. The m.p.s of group two chlorides (MCl_2) increase steadily down the group, viz. $BeCl_2 < MgCl_2 < CaCl_2 < SrCl_2 < BaCl_2$. This trend is in sharp contrast to alkali metal chlorides (MCl) viz. $LiCl < NaCl < KCl > RbCl > CsCl$. The following four reasons may be given. Some of them may be wrong. The reasons are :

    (1) The nature of bonding varies from covalent to ionic down the group.

    (2) The coordination number of metal ions increases and so the Madelung's constant (i.e. Lattice energy) increases from Be to Ba.

    (3) The radius of Cl^- ion is so large whereas that of M^{2+} ions is less. This causes Cl^- to Cl^- repulsion to decrease.

    (4) There is a decrease in the I.P. of the alkaline earth metal ions $\left(\text{i.e. } M_{(s)} \rightarrow M_{(g)}^{2+}\right)$ while in alkali metal ions, there is an increase in I.P. from K to Cs.

    Out of these alternatives, pick the wrong one.

(a) (1), (2), (3) (b) (1), (2), (4) (c) (4) only (d) (2) and (4)

80. The following reactions are given :

$$XeF_2 + SiO_2 \rightarrow A + SiF_4$$

$$XeF_2 + Pt \rightarrow B + PtF_4$$

$$XeF_2 + SbF_5 \rightarrow C + [C][SbF_6]$$

Here A, B and C respectively are :

(a) $Xe(A), XeO_3(B), Xe^{2+}(C)$

(b) $Xe(O_3)(A), Xe(B), (XeF)^+(C)$

(c) $XeO_4(A), PtF_4(B), [XeF_3]^+(C)$

(d) $Xe_{(g)}(A), XeO_3(B), [XeF]^+$

81. Which ones of the following statements are wrong in satisfactory description of bonding in electron deficient boron hydrides ?

(1) It must show that each bond – both two and three centered-contains two electrons, (conservation of electron rule)

(2) It must show that in the bonding, eah boron atom uses all its four orbitals and each H-atom, its 1s orbital (valence)

(3) The bonding one, thus, gets out of the 2-centered and 3-centered bonds should not be consistent with the structure of hydrides.

(a) (1), (2) (b) (1), (3) (c) (2), (3) (d) (3) only

82. Graphite is a layered structure solid.

(1) Within a layer or graphite, the type of bond Ⓐ best describes the bonding

(2) Between the different layers, the type of bonding is Ⓑ

(3) Graphite is relatively good electric conductor, Ⓒ type of electrons are mobile and therefore, these are able to conduct the electric current.

Here Ⓐ, Ⓑ and Ⓒ respectively are :

(a) Ⓐ-ionic, Ⓑ-covalent, Ⓒ σ-type

(b) Ⓐ-covalent, Ⓑ van der Wall Ⓒ Π-type

(c) Ⓐ-covalent, Ⓑ-Hydrogen, Ⓒ Π-type

(d) Ⓐ-ionic, Ⓑ covalent, Ⓒ σ-type

83. The reason for impossibility of separation and isolation of isomers Cis-$[Cu - Cl_2(NH_3)_4]$ and trans-$[Cu - Cl_2(NH_3)_4]$ from their mixture in solution is :

(a) Both are unstable in solution

(b) Both are labile

(c) Cis-$[CuCl_2(NH_3)_4]$ decomposes in solution

(d) Both gets polymerised

84. The noble gas with the most extensive chemical properties is Ⓐ. Compounds with A – F, A – O and A – N bonds are known and the most important oxidation states are Ⓒ.

Here Ⓐ, Ⓑ and Ⓒ respectively are :

(a) Argon, halogen, +2, +6

(b) Neon, Nitrogen, +4, +6

(c) Xe, Nitrogen(N), +2, +4, +6

(d) Rn, Sulphur(S), +2, +4

85. The Ⓐ and m in the following reaction respectively are :

$$BrO_3^- + F_2(g) + 2(OH)^- \rightarrow Ⓐ + m \text{ water}$$

(a) $Br_2 + 8$ (b) $[BrO_4]^-(aq), 2$ (c) $[HBrO], 4$ (d) $[Br_2O_7], 5$

86. For s and p valence orbitals, overlap decreases on **A** group of periodic table while **B** is true for the transition metals. That is why the heat of atomisation of the main group metals **C** with increasing atomic numbers while **B** trend is observed for transition metals.
    Here **A, B** and **C** respectively are :
    (a) ascending, opposite, increases   (b) descending, opposite, falls
    (c) descending, the same, goes up   (d) ascending, the same, falls

87. Relative Lewis acidity in decreasing order of

    $Li_4(CH_3)_4, B(CH_3)_3, Si(CH_3)_4$ and $\left[Si(CH_3)Cl_3\right]$ is :

    (a) $\left[Si(CH_3)_0 Cl_3\right] > Si(CH_3)_4 > B(CH_3)_3 > Li_4(CH_3)_4$

    (b) $Si(CH_3)_4, Si(CH_3)Cl > B(CH_3)_3 > Li_4(CH_3)_4$

    (c) $Li_4(CH_3)_4 > Si(CH_3)_4 > Si(CH_3)Cl_3 > B(CH_3)_3$

    (d) $B(CH_3)_3 > \left[Li_4(CH_3)_4\right] > Si(CH_3)Cl_3 > Si(CH_3)_4$

88. The structures of boron and nitrogen compounds [viz. BN type] :
    (a) similar to graphite only, but it is non-conducting
    (b) similar to diamond only, it can be used as very hard material
    (c) similar to both graphite and diamond types with the properties given in (a) and (b)
    (d) similar to NaCl type where B is (+ve) and nitrogen is (–ve) species

89. The simple iron porphyrine cannot function as O_2 carrier. It is because, the complex is :
    (a) unstable in solution   (b) polymerized
    (c) forms Fe – O – O – Fe bridge   (d) forms Fe_2O_3

90. Polynuclear carbonyls are coloured and their intensity increases with number of metal ions. Their colour arises from electronic transitions between orbitals that are largely localized on :
    (a) the ligands viz. CO
    (b) metal framework
    (c) oxygen atoms of CO group not involved in bonding
    (d) carbon atoms of CO, which are not involved in bonding

91. The role of the reaction,

    $$SO_2 + \frac{1}{2}O_2 + H_2O \xrightarrow[500t]{HC, NO} H_2SO_4,$$
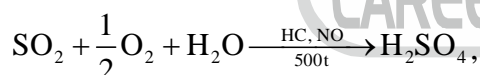
    in the environment is :

    (a) global warming   (b) acid rain   (c) SO_2 poisoning   (d) Oxygen consumption

92. The importance of the reaction,

    $$CO_2 + H_2O \xrightarrow{h\nu} (CH_2O) + O_2,$$
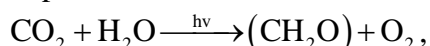
    in the environment is :
    (a) sun radiation balance   (b) green-house effect
    (c) photosynthesis   (d) respiration

93. 'Speciation' means :
    (a) segregation of chemical species   (b) aggregation of chemical species
    (c) identification of chemical species   (d) spuminess of chemical species

94. Which one is sink for CO_2 gas ?
    (a) Coal   (b) Ocean   (c) Wood   (d) Fire

95. The region of unadsorbed radiation by atmospheric window is :
    (a) 800-1300 nm   (b) 8000-13000 nm   (c) 14000-25000 nm   (d) 4000-8000 nm

96. Select the procedure which you consider most appropriate for the quantitative analysis of organic functional group of starting reactant in the following reaction :
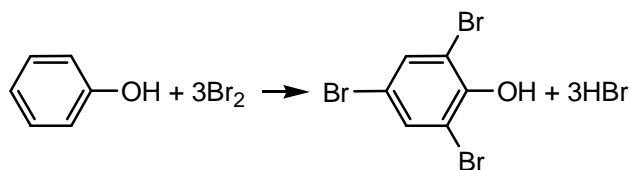
    (a) Potassium bromate oxidation   (b) Periodate oxidation
    (c) Precipitation titration   (d) Karl-Fischer titration

97. The methylated mercury in ecoaquatic system can be found due to :
    (a) the discharge of methylated mercury from the industry
    (b) the discharge of methylated mercury from the seed redressal
    (c) the discharge of methylated mercury from the chemical and clinical laboratories
    (d) the biological methylation of mercury

98. The concentration parts per billion (ppb) is :
    (a) g/L   (b) mg/L   (c) μg/L   (d) mol/L

99. The percentage transmittance (T) can be related to the absorbance (A) as ;
    (a) $\% \, T = 2 - \log A$ (b) $A = 2 - \log \% \, T$ (c) $A = \log \% \, T - 2$ (d) $\% \, T = \log A - 2$

100. The results of an analysis are 36.97 g, compared with the accepted value of 37.06 g. The relative error in parts per thousand is :
    (a) –2.40   (b) –24.0   (c) –0.24   (d) –0.024

101. The coefficient of variation is :
    (a) %RSD   (b) RSD   (c) SD   (d) SD^2

102. The mean and the standard deviation of the following set of analytical results :
    15.67 g, 15.69 g, 16.03 g are :
    (a) 15.80, 0.20 g   (b) 15.80, 0.02 g   (c) 15.80, 2.00 g   (d) 15.80, 0.002 g
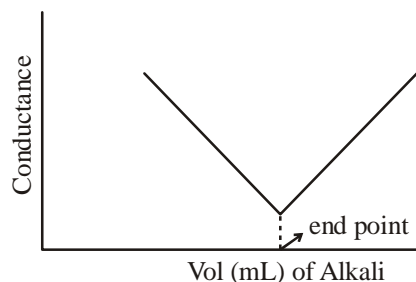
103. The equation for a normal error curve has the form :

    (a) $Y = \dfrac{e^{-\left\{(x-\mu)^2/2\sigma^2\right\}}}{\sigma\sqrt{2\pi}}$ (b) $Y = \dfrac{\sigma\sqrt{2\pi}}{e^{-\left\{(x-\mu)^2/2\sigma^2\right\}}}$ (c) $Y = \dfrac{\sigma.2\pi}{e^{-\left\{(x-\mu)^2/2\sigma^2\right\}}}$ (d) $Y = \dfrac{2\pi\sigma^2}{e^{-\left\{(x-\mu)^2/2\sigma^2\right\}}}$

104. The relationship between distribution ratio (D) and distribution coefficient $\left(K_D\right)$ for a weak acid can be represented as :

    (a) $D = \dfrac{1/K_D}{1 + K_a/\left[H^+\right]}$ (b) $D = \dfrac{1 + K_D}{1 + K_a/\left[H^+\right]}$ (c) $D = \dfrac{K_D}{1 + K_a/\left[H^+\right]}$ (d) $D = \dfrac{K_a}{1 + K_D/\left[H^+\right]}$

105. Twenty milliliters of an aqueous solution of 0.10 M butyric acid is shaken with 10 mL ether. After the layers are separated, it is determined by titration that 0.5 mmol butyric acid remains in the aqueous layer. The distribution ratio and the percent of acid extracted are :
    (a) 60.0, 95%   (b) 30.0, 47%   (c) 6.0, 75%   (d) 12.0, 99%

106. Which one of the following Ce(IV) solutions is stable for a year even at more than room temperature?
    (a) Basic solution   (b) Acidic solution   (c) Neutral solution   (d) Moderate basic solution

107. In the potentiometric titration of KCl with 0.1 M AgNO$_3$, the equivalence point can be obtained from the given plot as :
   (a) 10 mL   (b) 20 mL   (c) 25 mL   (d) 15 mL

108. EDTA is a :
   (a) bidentate ligand   (b) tridentate ligand   (c) quadridentate ligand (d) hexadentate ligand

109. Which one used for the preparation of EDTA aqueous solution /
   (a) EDTA   (b) monosodium salt of EDTA
   (c) disodium salt of EDTA   (d) tetrasodium salt of EDTA

110. Which parameter has no unit ?
   (a) Transmittance   (b) Path length   (c) Absorptivity   (d) Solute concentration

111. Which of the following statements are true ?
   (1) Cation-exchange resins have primary amine group.
   (2) Cation-exchange resins have sulphonic acid group.
   (3) Anion-exchange resins have tertiary amine group.
   (4) Anion-exchange resins have carboxylic acid group.
   (a) 1 and 4   (b) 2 and 3   (c) 1 and 3   (d) 2 and 4

112. Which two statements are totally false ?
   (1) Beer's law is obeyed when aqueous solution of chromate is diluted with water.
   (2) Beer's law is obeyed when aqueous solution of chromate is made strongly acidic.
   (3) Beer's law is obeyed when aqueous solution of chromate is made strongly alkaline.
   (4) Beer's law is obeyed when aqueous solution of chromate is made perfectly neutral.
   (a) 2 and 3   (b) 1 and 2   (c) 1 and 4   (d) 3 and 4

113. Which two of following statements are totally true ?
   (1) In normal-phase chromatography, the stationary phase is polar.
   (2) In normal-phase chromatography, the stationary phase is non-polar.
   (3) In reverse-phase chromatography, the stationary phase is polar.
   (4) In reverse-phase chromatography, the stationary phase is non-polar.
   (a) 1 and 3   (b) 1 and 4   (c) 2 and 3   (d) 2 and 4

114. Planar chromatography methods include :
   (1) High performance liquid chromatography
   (2) Thin-layer chromatography
   (3) Paper chromatography
   (4) Electro chromatography
   (a) only 1   (b) both 1 and 2   (c) 2, 3 and 4   (d) 1, 2 and 3

115. Which one is 2-D chromatography ?
   (a) Gas chromatography   (b) HPLC
   (c) Paper chromatography   (d) Ion-exchange chromatography

116. The number of theoretical plates can be obtained from a chromatogram from the expression :

(a) $n = 16\left(\dfrac{t_R}{w}\right)^2$ (b) $n = 16\left(\dfrac{w}{t_R}\right)^2$ (c) $n = 16\dfrac{(t_R)^2}{w}$ (d) $n = 16\dfrac{t_R}{w^2}$

117. In the conductometric titration between an acid and base, the graph :

represents a titration between :
(a) Strong acid and strong base   (b) Strong acid and weak base
(c) Weak acid and strong base   (d) Weak acid and weak base

118. The transition pH range of phenolphthalein is :
(a) 1-4   (b) 4-6   (c) 8-10   (d) 12-14

119. The optimum dissolved oxygen in natural water is :
(a) 1-2 ppm   (b) 2-4 ppm   (c) 4-6 ppm   (d) 6-8 ppm

120. Which region of the atmosphere contains ozone ?
(a) Troposphere   (b) Stratosphere   (c) Mesosphere   (d) Thermosphere