

**BHU M.Sc. CHEMISTRY ENTRANCE - 2017**

1. The (A) model regards lattice energy as determining stabilization-factor of chemical bonding in crystalline solid state. Here (A) is:
- (a) Molecular orbital (b) Valence bond
(c) Ionic (d) Covalent
2. 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) Square planar, Tetrahedral, Linear, T-shaped
(c) Tetrahedral, Tetrahedral, Linear, Linear
(d) Square planar, Square planar, Angular, Linear
3. 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) $-2.0 \Delta_0$
4. 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 (A). It is a (B) type of defect.
- Here (A) and (B) respectively are:
- (a) Schottky, Extrinsic point (b) Schottky, Intrinsic point
(c) Frenkel, Intrinsic point (d) Frenkel, Extrinsic point.
5. The magnetic moment of an octahedral Co^{2+} (d^7) complex is 4.0 B.M. The crystal field due to ligands around the metal ion is (A) and the total number of electrons in $d_{x^2-y^2}$ and d_{z^2} are (B). Here (A) and (B) respectively are:
- (a) Strong, Six (b) Strong, Three (c) Weak, Six (d) Weak, Two



6. 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
7. 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 :



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

- (a) b and a (b) c and a (c) a and b (d) b and c
8. Out of the following molecules/ions, the ones which are isoelectronic with N_2 and NH_3 respectively are:
- (A) CO_3^{2-} (B) Ozone (C) Oxalate ion (D) N_3^- (E) 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 CO_3^{2-} and NH_3 with O_3
9. The value of $\beta \left(\frac{B}{B_0} \right)$ of a ligand shows the extent of (A) in the M-L bond of the complex and also the extent of delocalization of ligand electrons. It's value is (B) for the electrons in (C) and (d) ORBITALS. Since the σ overlap of (D) is usually larger than the π -orbital overlap of (C), the cloud expansion is larger in the former case.
- Here (A), (B), (C) and (D) respectively are:



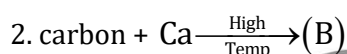
- (a) ionicity, higher, t_{2g}, e_g (b) ionicity, lower, e_g, t_{2g}
(c) covalence, different, t_{2g}, e_g (d) covalence, higher, e_g, t_{2g}
10. In CsCl ionic solid structure, the coordination number of Cs^+ and Cl^- ions respectively are:
(a) 6 and 8 (b) 8 and 8 (c) 4 and 6 (d) 6 and 4
11. Which one of the following molecules will show optical activity and is a chiral molecule?
(A) $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$ [octahedral] (B) $\text{Cis}-[\text{PtCl}_2(\text{CN})_2]$ square planar
(C) $\text{cis}-[\text{RhCl}_2(\text{NH}_3)_4]$ octahedral (D) $[\text{Ru}(\text{bipy})_3]$ octahedral
The correct alternative out of the following four alternatives is:
(a) All the four molecules are chiral
(b) A and C are chiral and B and D are achiral
(c) A and D are chiral and B and C are achiral
(d) A, B, C are chiral and D achiral.
12. 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) $\text{Fe}^{+2/+3}$
13. The transition metal ions ($\text{V}, \text{Mn}, \text{Fe}, \text{Co}, \text{Cu}$) are used in redox enzymes in preference of $\text{Zn}^{2+}, \text{Ga}$ and Ca^{2+} . The reason is that:
(a) These have spectral bands in the visible region
(b) These have variable valence or oxidation states
(c) These produce a specific magnetic field in the cell
(d) The metal ions are coloured.
14. In transition metal tetrahedral complexes one has lower value of Δ (i.e. $\Delta_t < \Delta_o$). Further t_2 and C orbitals are (A) affected by Π -bonding. Although $\Delta_t < \Delta_o$, but the electronic parameter β is (B) affected and thus all tetrahedral complexes are (C) spin.



Here (A), (B) and (C) respectively are:

- (a) equally, the same, high (b) more, same, high
(c) less, lesser, low (d) less, more, high

15. In the reactions:



the products (A) and (B) 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

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

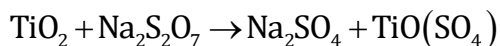
- (a) Two center-two electron bond ($2c-2e$)
(b) Three center-two electron bond ($3c-2e$)
(c) Four center-two electron bond ($4c-2e$)
(d) Five center-two electron bond ($5c-2e$)

17. In the following list:

(A) $B(CH_3)_3$, (B) $B(OCH_3)_3$, (C) $SiCl_3(CH_3)$, (D) $[N(CH_3)_3]$, (E) $[NaCH_3COO]$ 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) $B(OCH_3)_3$, $[Na(CH_3COO)]$
(d) $[Na(CH_3COO)]$, $B(CH_3)_3$

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



The acid and base in the reaction are:

- (a) Ti^4 as base and Na in $\text{Na}_2\text{S}_2\text{O}_7$ as acid
- (b) $\text{S}_2\text{O}_7^{2-}$ 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

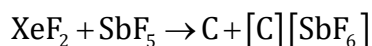
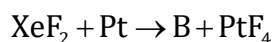
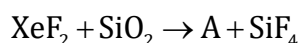
19. The m.p.s of group two chlorides (MCl_2) increase steadily down the group, viz. $\text{BeCl}_2 < \text{MgCl}_2 < \text{CaCl}_2 < \text{SrCl}_2 < \text{BaCl}_2$. This trend is in sharp contrast to alkali metal chlorides (MCl) viz. $\text{LiCl} < \text{NaCl} < \text{KCl} > \text{RbCl} > \text{CsCl}$. The following four reasons may be given. Some of them may be wrong. The reasons are:

- (A) The nature of bonding varies from covalent to ionic down the group.
- (B) The coordination number of metal ions increases and so the Madelung's constant (i.e. Lattice energy) increases from Be to Ba.
- (C) The radius of Cl^- ions is so large whereas that of M^{2+} ions is less. This causes Cl^- to Cl^- repulsion to decrease.
- (D) There is a decrease in the I.P. of the alkaline earth metal ions (i.e. $\text{M}_{(s)} \rightarrow \text{M}_{(g)}^{2+}$) 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) a, b, c (b) a, b, d (c) d only (d) b and d

20. The following reactions are given:



Here A, B and C respectively are:



- (a) Xe(A), XeO₃(B), Xe²⁺(C) (b) Xe(O₃)(A), Xe(B), (XeF)⁺(C)
(c) XeO₄(A), PtF₄(B), [XeF₃]⁺(C) (d) Xe_(g)(A), XeO₃(B), [XeF]⁺

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

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

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

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

- (a) A, B (b) A, C (c) B, C (d) C only

22. Graphite is a layered structure solid.

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

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

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

Here (A), (B) and (C) respectively are:

(a) (A) -ionic, (B) -covalent, (C) σ -type

(b) (A) -covalent, (B) Van der Waal, (C) Π -type

(c) (A) -covalent, (B) Hydrogen, (C) Π -type

(d) (A) -ionic, (B) -covalent, (C) σ -type

23. The reason for impossibility of separation and isolation of isomers

Cis-[Cu-Cl₂(NH₃)₄] and trans-[Cu-Cl₂(NH₃)₄] from their mixture in solution is:

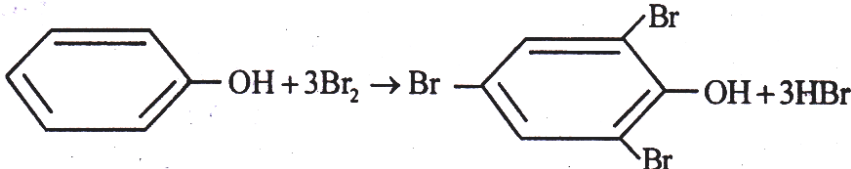


- (a) Both are unstable in solution
(b) Both are labile
(c) $\text{Cis} - [\text{CuCl}_2(\text{NH}_3)_4]$ decomposes in solution
(d) Both gets polymerised
24. The noble gas with the most extensive chemical properties is (A). Compounds with A-F, A-O and A-N bonds are known and the most important oxidation states are (C).
Here (A), (B) and (C) 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
25. The (A) and m in the following reaction respectively are:
 $\text{BrO}_3^- + \text{F}_2(\text{g}) + 2(\text{OH})^- \rightarrow (\text{A}) + m \text{ water}$
(a) $\text{Br}_2 + 8$ (b) $[\text{BrO}_4]^- (\text{aq}), 2$ (c) $[\text{HBrO}], 4$ (d) $[\text{Br}_2\text{O}_7], 5$
26. 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 atomization 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
27. Relative Lewis acidity in decreasing order of $\text{Li}_4(\text{CH}_3)_4, \text{B}(\text{CH}_3)_3, \text{Si}(\text{CH}_3)_4$ and $[\text{Si}(\text{CH}_3)\text{Cl}_3]$ is:
(a) $[\text{Si}(\text{CH}_3)_3\text{Cl}_3] > \text{Si}(\text{CH}_3)_4 > \text{B}(\text{CH}_3)_3 > \text{Li}_4(\text{CH}_3)_4$
(b) $\text{Si}(\text{CH}_3)_4, \text{Si}(\text{CH}_3)\text{Cl} > \text{B}(\text{CH}_3)_3 > \text{Li}_4(\text{CH}_3)_4$



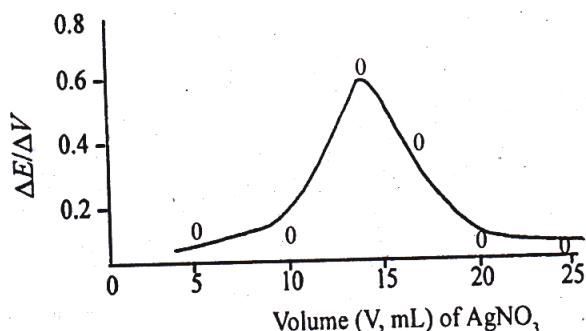
- (c) $\text{Li}_4(\text{CH}_3)_4 > \text{Si}(\text{CH}_3)_4 > \text{Si}(\text{CH}_3)\text{Cl}_3 > \text{B}(\text{CH}_3)_3$
- (d) $\text{B}(\text{CH}_3)_3 > [\text{Li}_4(\text{CH}_3)_4] > \text{Si}(\text{CH}_3)\text{Cl}_3 > \text{Si}(\text{CH}_3)_4$
28. The structures of boron and nitrogen compounds [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
29. 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
30. 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
31. The role of the reaction, $\text{SO}_2 + \frac{1}{2}\text{O}_2 + \text{H}_2\text{O} \xrightarrow[500^\circ\text{t}]{\text{HCl, NO}} \text{H}_2\text{SO}_4$, in the environment is:
- (a) global warming (b) acid rain
- (c) SO_2 poisoning (d) Oxygen consumption
32. The importance of the reaction, $\text{CO}_2 + \text{H}_2\text{O} \xrightarrow{h\nu} (\text{CH}_2\text{O}) + \text{O}_2$, in the environment is:
- (a) sun radiation balance (b) green-house effect
- (c) photosynthesis (d) respiration
33. 'Speciation' means:



- (a) segregation of chemical species (b) aggregation of chemical species
(c) identification of chemical species (d) spuminess of chemical species
34. Which one is sink for CO₂ gas?
(a) Coal (b) Ocean (c) Wood (d) Fire
35. 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
36. 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
37. 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
38. The concentration parts per billion (ppb) is:
(a) g/L (b) mg/L (c) µg/L (d) mol/L
39. The percentage transmittance (T) can be related to the absorbance (A) as:
(a) $5T = 2 - \log A$ (b) $A = 2 - \log \% T$ (c) $A = \log \% T - 2$ (d) $\% T = \log A - 2$
40. 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
41. The coefficient of variation is:



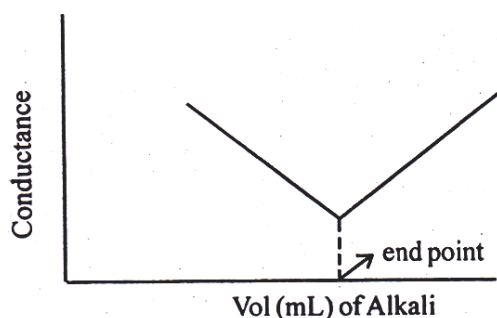
- (a) %RSD (b) RSD (c) SD (d) SD²
42. The mean and the standard deviation of the following set of analytical results: 15.67 g, 15.69 g, 16.03 g are:
- (a) 15.80, 0.20 g (b) 15.80, 0.02 g (c) 15.80, 2.00 g (d) 15.80, 0.002 g
43. The equation for a normal error curve has the form:
- (a) $Y = \frac{e^{-\{(x-\mu)^2/2\sigma^2\}}}{\sigma\sqrt{2\pi}}$ (b) $Y = \frac{\sigma\sqrt{2\pi}}{e^{-\{(x-\mu)^2/2\sigma^2\}}}$ (c) $Y = \frac{\sigma.2\pi}{e^{-\{(x-\mu)^2/2\sigma^2\}}}$ (d) $Y = \frac{2\pi\sigma^2}{e^{-\{(x-\mu)^2/2\sigma^2\}}}$
44. The relationship between distribution ratio (D) and distribution coefficient (K_D) for a weak acid can be represented as:
- (a) $D = \frac{1/K_D}{1+K_a/[H^+]}$ (b) $D = \frac{1+K_D}{1+K_a/[H^+]}$
(c) $D = \frac{K_D}{1+K_a/[H^+]}$ (d) $D = \frac{K_a}{1+K_D/[H^+]}$
45. 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%
46. 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
47. In the potentiometric titration of KCl with 0.1 M AgNO₃, the equivalence point can be obtained from the given plot as:
- (a) 10 mL (b) 20 mL (c) 25 mL (d) 15 mL



48. EDTA is a:
- (a) bidentate ligand (b) tridentate ligand
(c) quadridentate ligand (d) hexadentate ligand
49. 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
50. Which parameter has no unit?
- (a) Transmittance (b) Path length
(c) Absorptivity (d) Solute concentration
51. Which of the following statements are true?
- (A) Cation-exchange resins have primary amine group.
(B) Cation-exchange resins have sulphonic acid group.
(C) Anion-exchange resins have tertiary amine group.
(D) Anion-exchange resins have carboxylic acid group.
- (a) A and D (b) B and C (c) A and C (d) B and D
52. Which two statements are totally false?
- (A) Beer's law is obeyed when aqueous solution of chromate is diluted with water.
(B) Beer's law is obeyed when aqueous solution of chromate is made strongly acidic.
(C) Beer's law is obeyed when aqueous solution of chromate is made strongly alkaline.



- (D) Beer's law is obeyed when aqueous solution of chromate is made perfectly neutral.
- (a) B and C (b) A and B (c) A and D (d) C and D
53. Which two of following statements are totally true?
- (A) In normal-phase chromatography, the stationary phase is polar.
- (B) In normal-phase chromatography, the stationary phase is non-polar.
- (C) In reverse-phase chromatography, the stationary phase is polar.
- (D) In reverse-phase chromatography, the stationary phase is non-polar.
- (a) A and C (b) A and D (c) B and C (d) B and D
54. Planar chromatography methods include:
- (A) High performance liquid chromatography.
- (B) Thin-layer chromatography.
- (C) Paper chromatography.
- (D) Electro chromatography.
- (a) only A (b) both A and B (c) B, C and D (d) A, B and C
55. Which one is 2-D chromatography?
- (a) Gas chromatography (b) HPLC
- (c) Paper chromatography (d) Ion-exchange chromatography
56. The number of theoretical plates can be obtained from a chromatogram from the expression:
- (a) $n = 16 \left(\frac{t_R}{w} \right)^2$ (b) $n = 16 \left(\frac{w}{t_R} \right)^2$ (c) $n = 16 \frac{(t_R)^2}{w}$ (d) $n = 16 \frac{t_R}{w}$
57. 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
58. The transition pH range of phenolphthalein is:
 (a) 1-4 (b) 4-6 (c) 8-10 (d) 12-14
59. The optimum dissolved oxygen in natural water is:
 (a) 1-2 ppm (b) 2-4 ppm (c) 4-6 ppm (d) 6-8 ppm
60. Which region of the atmosphere contains ozone?
 (a) Troposphere (b) Stratosphere (c) Mesosphere (d) Thermosphere
61. 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
62. The energy can be represented in terms of partition function by the following equation:
 (a) $E = kT(\partial \ln Q / \partial T)_v$ (b) $E = kT^2(\partial \ln Q / \partial T)_v$
 (c) $E = k/T(\partial \ln Q / \partial T)_v$ (d) $E = k/T^2(\partial \ln Q / \partial T)_v$
63. 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
64. According to Bose-Einstein statistics the maximum probability distribution is:
 (a) $n_i / g = 1 / e^{\alpha + \beta \epsilon_i}$ (b) $n_i / g = 1 / e^{\alpha + \beta \epsilon_i} - 1$



- (c) $n_i / g = 1 / e^{\alpha + \beta \epsilon_i} + 1$ (d) None of these.
65. The concept of Excess Functions is applicable to:
(a) Non-ideal solution (b) Ideal solutions
(c) Phase equilibrium (d) Exact differentials
66. Canonical Ensembles are:
(a) Isolated systems (b) Closed isothermal systems
(c) Open isothermal systems (d) Imaginary systems
67. Which of the following partition functions will be substantially larger than unity?
(a) Electronic (b) Vibrational (c) Rotational (d) Translational
68. In Fermi-Dirac statistics the particles are:
(a) Indistinguishable (b) Distinguishable
(c) Adsorbed (d) Absorbed
69. 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 stands for _____ corresponding to J_1 and J_2 .
(a) Mole fractions (b) Forces
(c) Molar concentrations (d) Chemical potentials
70. 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) $I_d = 706 n D^{1/3} m^{2/3} t^{1/2} c$
71. 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
72. 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
73. 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

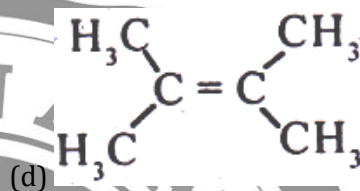
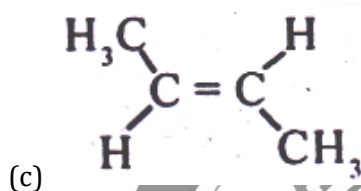
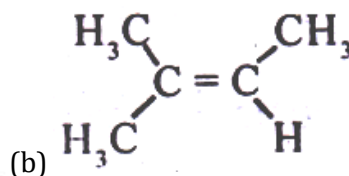
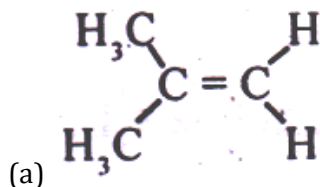


- (c) $4.0 \text{ mole}^{-1} \text{ litre}^{-1}$ (d) $8.0 \text{ mole}^{-1} \text{ litre}^{-1}$
74. On increasing the temperature the rate of reaction is doubled per 10°C . If the temperature is increased by 50°C , then the rate of reaction will increase:
(a) 12 times (b) 16 times (c) 32 times (d) 50 times
75. 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.
76. 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) $dP/dT = L/T(P_2 - P_1)$
77. 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
78. Which of the following is true for an orthorhombic lattice?
(a) $a = b = c, \alpha = \beta = \gamma = 90^\circ$ (b) $a \neq b \neq c, \alpha = \beta = \gamma = 90^\circ$
(c) $a \neq b \neq c, \alpha = \gamma = 90^\circ, \beta \neq 90^\circ$ (d) $a = b \neq c, \alpha = \beta = \gamma$
79. Which of the following is the correct order of surface area per molecule/ Nm^2 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
80. Cu-Ni alloy is an example of:
(a) Substitutional solid solution (b) Interstitial solid solution
(c) Mixture (d) None of these.
81. Which of the following refractive material has highest melting point



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

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



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

- (a) $\text{C}-\text{C} > \text{C}=\text{C} > \text{C}\equiv\text{C}$ (b) $\text{C}\equiv\text{C} > \text{C}=\text{C} > \text{C}-\text{C}$
(c) $\text{C}-\text{C} > \text{C}=\text{C} < \text{C}\equiv\text{C}$ (d) $\text{C}=\text{C} < \text{C}-\text{C} > \text{C}\equiv\text{C}$

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

- (a) $\log I_0 / I = -\epsilon Cl$ (b) $\log I_0 / I = \epsilon Cl$ (c) $\log I / I_0 = -\epsilon Cl$ (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.

85. The vibrational degrees of freedom for $\text{CH}_2 = \text{CHCH}_2\text{Br}$, CO_2 and SO_2 are:

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

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

- (a) $\text{CH}_3\text{F} > \text{CH}_3\text{Cl} > \text{CH}_3\text{Br} > \text{CH}_3\text{I}$ (b) $\text{CH}_3\text{Cl} > \text{CH}_3\text{F} > \text{CH}_3\text{Br} > \text{CH}_3\text{I}$
(c) $\text{CH}_3\text{I} > \text{CH}_3\text{Br} > \text{CH}_3\text{Cl} > \text{CH}_3\text{F}$ (d) $\text{CH}_3\text{I} < \text{CH}_3\text{Br} > \text{CH}_3\text{F} > \text{CH}_3\text{Cl}$

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

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



88. A solution containing one mole for litre each of $\text{Cu}(\text{NO}_3)_2$, AgNO_3 , $\text{Hg}(\text{NO}_3)_2$ and $\text{Mg}(\text{NO}_3)_2$ is electrolyzed using inert electrodes.

Standard electrode potentials in volts (reduction potentials) are:

$$\text{Ag}^+|\text{Ag} = 0.80$$

$$\text{Hg}^{2+}|\text{Hg} = 0.79$$

$$\text{Cu}^{2+}|\text{Cu} = 0.34$$

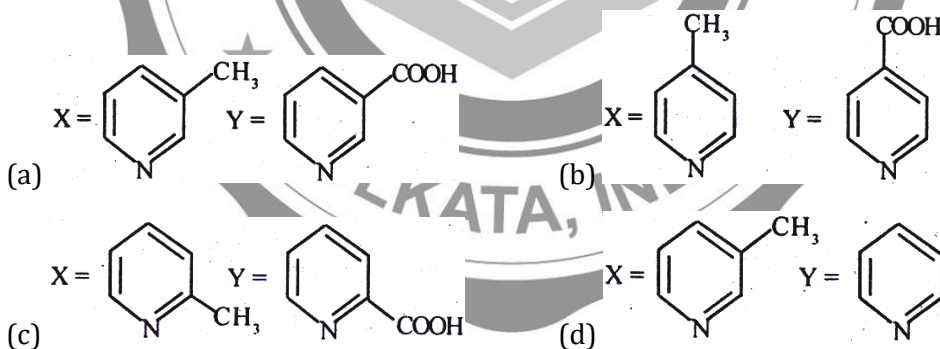
$$\text{Mg}^{2+}|\text{Mg} = -2.37$$

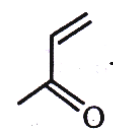
With increasing voltage, the sequence of deposition of metals on the cathode will be:

- (a) Ag, Hg, Cu, Mg (b) Mg, Cu, Hg, Ag (c) Ag, Hg, Cu (d) Cu, Hg, Ag
89. $E^\circ(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$. What is the value of E (at 298 K) for an aqueous solution in which $[\text{Cu}^{2+}] = 0.02 \text{ mol dm}^{-3}$?
- (a) 0.29 V (b) 0.32 V (c) 0.39 V (d) 0.36 V
90. 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 the both the forward and reverse processes.
(c) It may be recovered unchanged at the end of the reaction.
(d) It increases the equilibrium constant.
91. 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
92. 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
93. Which one of the following sugar is non-reducing?
(a) Fructose (b) Sucrose (c) Lactose (d) Maltose
94. 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
95. 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
96. Quinoline on reduction leads to the formation of decahydroquinoline using one of the following:
(a) LiAlH_4 (b) $\text{Na} - \text{Liq. NH}_3$
(c) H_2 / Ni (d) H_2 , Pt in CH_3COOH
97. $2\text{CH}_2 = \text{CHCHO} + \text{NH}_3 \rightarrow \text{X} \xrightarrow{\text{K}_2\text{Cr}_2\text{O}_7, \text{H}_2\text{SO}_4} \text{Y}$ where X and Y are:

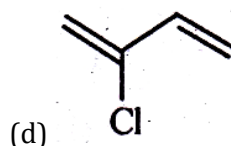
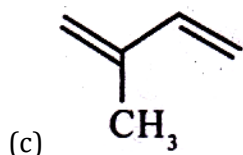
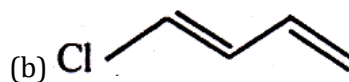
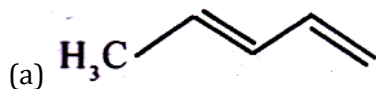


98. Isoprene +  $\xrightarrow[\text{ii) } \text{H}^+]{\text{i) } \text{CH}_3\text{MgBr}}$ X
- (a) α -terpeniol (b) Formation of CO_2
(c) Formation of N_2 (d) Formation of Cl_2



99. 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
100. Sulphur containing amino acid combination is
- (a) Cysteine and Glutamine (b) Glutamine and Methionine
(c) Cysteine and Methionine (d) Tryptophan and methionine
101.
102. Ziegler-Natta catalyst used in polymerization of olefins is:
- (a) $\text{Al}(\text{CH}_3)_3$ and TiCl_3 (b) $\text{Al}(\text{C}_2\text{H}_5)_3$ and TiCl_3
(c) $\text{Al}(\text{C}_2\text{H}_5)_3$ and TiCl_4 (d) $\text{Al}(\text{CH}_3)_3$ and TiCl_4
103. 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
104. Polyurethanes are formed from the reaction of:
- (a) Urea and Formaldehyde (b) Isocyanate and alcohol
(c) Urea and alcohol (d) Isocyanate and Formaldehyde

105. Polymerization unit of Neoprene is:



106. 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

107. Phenolphthalein dye is synthesized by the reaction of phthalic anhydride with

(a) Resorcinol

(b) p-Hydroxyphenol

(c) p-Nitrophenol

(d) Phenol

108. Geraniol belongs to which class of terpenoids and how many isoprene units are there in it?

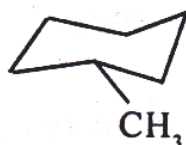
(a) Diterpene, two units

(b) Monoterpenes, one unit

(c) Diterpenes, one unit

(d) Monoterpenes, two units

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



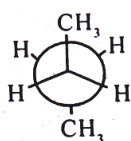
(a) Equatorial, more stable

(b) Axial, more stable

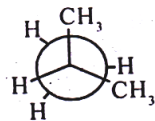
(c) Equatorial, less stable

(d) Axial, less stable

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



(I)



(II)



- (a) has more torsional strain
(b) has more torsional strain
(c) has more steric strain
(d) Both have more steric strain
111. In the boat confirmation of cyclohexane, the most destabilizing interaction is:
(a) Eclipsing
(b) 1, 3-diaxial
(c) 1, 3-diequatorial
(d) flagpole-flagpole
112. 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
113. The reactive intermediate involved in the reaction of benzene with diazomethane is:
(a) Carbocation
(b) Carbanion
(c) Carbene
(d) Free radical
114. Carbene for formed as an intermediate in:
(a) Pinacol-pinacolone Rearrangement
(b) Hoffmann Rearrangement
(c) Beckmann Rearrangement
(d) Wolf Rearrangement
115.
(a)
(b)
(c)
(d)
116. 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
117. 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
- 118.** n-Propylbromide on treatment with ethanolic KOH gives:
- (a) Propane (b) Propene (c) Propyne (d) Propanol
- 119.** 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
- 120.** 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