

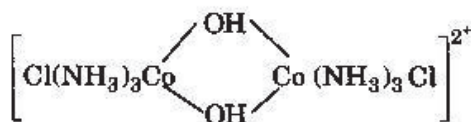
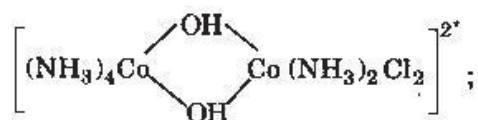
## CHEMISTRY

1. The effective nuclear charge decreases due to :
  - (a) decrease in the number of intervening electrons
  - (b) increase in the size of the atom
  - (c) decrease in the screening constant
  - (d) less number of valence electrons
2. Which quantum number exhibits Zeeman effect ?
  - (a) Principal quantum number
  - (b) Azimuthal quantum number
  - (c) Magnetic quantum number
  - (d) Spin quantum number
3. In square planar geometry, four square planar  $dsp^2$  hybrids are formed by mixing :
  - (a)  $s$ ,  $p_x$ ,  $p_y$  and  $d_{z^2}$  orbitals
  - (b)  $s$ ,  $p_x$ ,  $p_y$  and  $d_{x^2-y^2}$  orbitals
  - (c)  $s$ ,  $p_x$ ,  $p_y$  and  $d_{xy}$  orbitals
  - (d)  $s$ ,  $p_x$ ,  $p_y$  and  $d_{xz}$  orbitals
4. On the basis of MOT, the ionisation energy of  $N_2$  molecule is higher than that of NO molecule because during ionisation of  $N_2$  molecule, the electron is to be removed from :
  - (a) Antibonding molecular orbital
  - (b) Bonding molecular orbital
  - (c) Non-bonding orbital
  - (d)  $\pi$  bonding orbital

5. In the given reaction;  $I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$ ; the equivalent weight of iodine will be equal to :
- (a) Its molecular weight
  - (b)  $\frac{1}{2}$  of its molecular weight
  - (c)  $\frac{1}{4}$  of its molecular weight
  - (d) Twice its molecular weight
6. When  $KMnO_4$  is reduced with oxalic acid in acidic medium, the oxidation number of Mn changes from :
- (a) 7 to 4
  - (b) 6 to 4
  - (c) 7 to 2
  - (d) 4 to 2
7. What is the *correct* order of the following ions as Bronsted bases ?
- (a)  $F^- > OH^- > NH_2^- > CH_3^-$
  - (b)  $CH_3^- < NH_2^- < OH^- < F^-$
  - (c)  $F^- < NH_2^- < CH_3^- < OH^-$
  - (d)  $CH_3^- > NH_2^- > OH^- > F^-$
8. Amongst the trihalides of boron,  $BF_3$  has a weak Lewis acid character because :
- (a)  $BF_3$  is a small molecule
  - (b)  $BF_3$  does not exhibit back bonding
  - (c) Effectiveness of  $p\pi - p\pi$  bonding is maximum in  $BF_3$
  - (d)  $BF_3$  molecule shows double bond character

9. Lithium nitrate on heating gives :
- (a)  $\text{LiO}_2$ ,  $\text{NO}_2$  and  $\text{O}_2$
  - (b)  $\text{LiNO}_2$  and  $\text{O}_2$
  - (c)  $\text{Li}_3\text{N}$ ,  $\text{NO}$  and  $\text{O}_2$
  - (d)  $\text{Li}_2\text{O}$ ,  $\text{N}_2$  and  $\text{O}_2$
10. The hydroxides of which of the following pairs of elements are insoluble in water and amphoteric :
- (a) Ca, Sr
  - (b) Ba, Sr
  - (c) Be, Mg
  - (d) Mg, Ca
11. The relative order of basic strength of trihydrides of the elements of group 15 varies as follows :
- (a)  $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$
  - (b)  $\text{NH}_3 > \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$
  - (c)  $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
  - (d)  $\text{NH}_3 < \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
12. What would be the value of effective magnetic moment ( $\mu_{\text{eff}}$ ) for a complex ion, whose central metal ion has four unpaired electrons in it ?
- (a) 4.90 BM
  - (b) 5.92 BM
  - (c) 3.87 BM
  - (d) 2.83 BM
13. Catalytic activity exhibited by transition metals and their compounds is due to :
- (a) Vacant orbitals available in these metals
  - (b) Variable oxidation states shown by these metals
  - (c) Availability of large surface area on which the reactants may be adsorbed
  - (d) All of the above reasons

14. The aqueous solution of the salt will be coloured in case of :
- $Zn(NO_3)_2$
  - $LiNO_3$
  - $Co(NO_3)_2$
  - $Ca(NO_3)_2$
15. One of the characteristic of the transition metals to form the complex ion is :
- having unpaired electrons in *d*-sub-shell
  - having paired electrons in *d*-sub-shell
  - having small charge and size ratio
  - having empty *d*-orbitals
16. What type of isomerism would you assign to the following pair of compounds ?



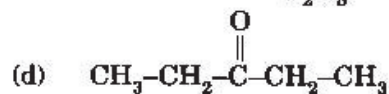
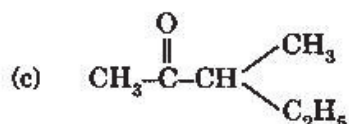
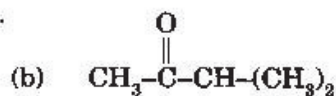
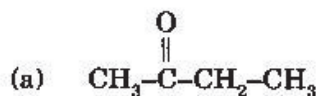
- Coordination isomerism
  - Coordination position isomerism
  - Linkage isomerism
  - Ligand isomerism
17. The total pairing energy for  $[Cr(OH_2)_6]^{2+}$  ion in high spin state is :
- 0
  - 1P
  - 2P
  - 3P

18. Which one of the following is the bulk structural and essential element ?
- (a) Carbon
  - (b) Sodium
  - (c) Iron
  - (d) Manganese
19. The elements of Group 13 like Boron and Aluminium form :
- (a) Inorganic organometallic compounds
  - (b) Sigma covalent organometallic compounds
  - (c) Pi-covalent organometallic compounds
  - (d) Sandwich organometallic compounds
20. In metal alkenes, the bond length of C=C bond in coordinated olefin :
- (a) remains unchanged
  - (b) decreases
  - (c) increases
  - (d) depends on the nature olefins coordinated to the metal
21. The reactive intermediate which displays trigonal planar geometry is :
- (a) Carbocation
  - (b) Carbanion
  - (c) Carbene
  - (d) Benzyne
22. The stereoisomer which exhibits different physical and chemical properties on reaction with both chiral and achiral reagents is :
- (a) A pair of enantiomers
  - (b) Meso compounds
  - (c) A pair of diastereoisomers
  - (d) An enantiomer and its racemic form

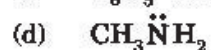
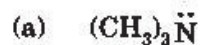
23. Which amongst the following compounds will exhibit Meso form ?
- (a) 2, 3, dibromobutane
  - (b) 3, 3, dibromobutane
  - (c) 2, 3 dibromopentane
  - (d) 2, 4 dibromopentane
24. The base catalysed dehydrobromination of which of the following compounds would be governed by Saytzev's rule :
- (a) 1, bromopropane
  - (b) 2, bromopropane
  - (c) 1, bromobutane
  - (d) 2, bromobutane
25. The alkyl bromide which will display the slowest rate of nucleophilic substitution reaction (Hydrolysis) in 80% water and 20% ethanol at 25°C is :
- (a)  $\text{CH}_3\text{Br}$
  - (b)  $\text{CH}_3\text{CH}_2\text{Br}$
  - (c)  $(\text{CH}_3)_3\text{C-Br}$
  - (d)  $(\text{CH}_3)_2\text{CHBr}$
26. Treatment of optically pure (R)-2-butanol with thionyl chloride gives predominantly (R)-2-chlorobutane. The reaction proceeds through :
- (a)  $\text{S}_\text{N}^1$  mechanism
  - (b)  $\text{S}_\text{N}^2$  mechanism
  - (c)  $\text{S}_\text{N}^i$  mechanism
  - (d) Neighbouring group participation

27. The acid catalysed condensation between a carbonyl compound and a secondary amine leads to formation of :
- (a) an enamine
  - (b) an imine
  - (c) an aminol
  - (d) a hydrazone
28. The product that would be formed when benzaldehyde is treated with formaldehyde in 50% NaOH is :
- (a)  $C_6H_5CH_2OH$  and  $C_6H_5COO^-Na^+$
  - (b)  $C_6H_5CH_2OH$  and  $HCOO^-Na^+$
  - (c)  $C_6H_5COO^-Na^+$  and  $CH_3OH$
  - (d)  $C_6H_5CH_2OH$  and  $HCOOH$
29. The compound which will undergo Pinacol-Pinacolone rearrangement is :
- (a) 1, 2, ethanediol
  - (b) 1, 2, 3, propanediol
  - (c) 2, methyl, 2, 3, butanediol
  - (d) 2, 3, dimethyl, 2, 3, butanediol
30. The reaction between the following sequence chemical compounds which will lead to the formation of Mannich bases through Mannich reaction is :
- (a)  $CH_3COCH_3 + CH_2O + NH_3$
  - (b)  $C_6H_5COCH_3 + CH_3CHO + CH_3NH_2$
  - (c)  $C_6H_5COCH_3 + HCHO + HN(CH_3)_2$
  - (d)  $C_6H_5COC_6H_5 + HCHO + HN(C_2H_5)_2$

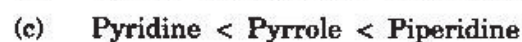
31. Which of the following ketones can not be prepared starting from acetoacetic ester ?



32. Which of the following amines upon interaction with a proton, would give rise to strongest conjugate acid ?



33. The correct increasing order of basicity of following different amines is :



34. The product that is obtained due to reaction between pyrrole and methyl magnesium bromide is :





35. The ultraviolet spectrum of a simple carbonyl compound shows two peaks at 280 nm and 190 nm. These could be attributed respectively to :
- $\pi \rightarrow \pi^*$  and  $n \rightarrow \pi^*$  transitions
  - $n \rightarrow \pi^*$  and  $\pi \rightarrow \pi^*$  transitions
  - $\sigma \rightarrow \pi^*$  and  $\pi \rightarrow \sigma^*$  transitions
  - $n \rightarrow \sigma^*$  and  $\pi \rightarrow \pi^*$  transitions
36. An organic compound displays a strong carbonyl group absorption in the infra-red spectrum at  $1750 \text{ cm}^{-1}$  due to the presence of :
- Ester carbonyl group
  - Amide carbonyl group
  - Acid carbonyl group
  - Aldehydic carbonyl group
37. In the NMR spectra, which of the following underlined protons would be most highly deshielded :
- $\text{CH}_3\text{CH}_2\text{OH}$
  - $\begin{array}{c} \text{O} \\ || \\ \text{CH}_3-\text{C}-\underline{\text{H}} \end{array}$
  - $\text{C}_6\text{H}_5-\underline{\text{CH}_3}$
  - $\text{CH}_3\underline{\text{CH}_2}-\text{Br}$
38. Which of the following amino acids can *not* participate in H-bonding involved in the  $\alpha$ -helix structure of proteins ?
- Glycine
  - Proline
  - Leucine
  - Histidine

39. The invert sugar is chemically composed of :
- (a) 100% D-Glucose
  - (b) 100% D-Fructose
  - (c) 50 : 50 Mixture of Glucose and Fructose
  - (d) 100% Sucrose only
40. Which amongst the following compounds on reaction with a Grignard reagent will not yield an alcohol ?
- (a) Formaldehyde
  - (b) Acetone
  - (c) Acetic acid
  - (d) Acetaldehyde
41. The differential and integral of which of the functions is equal to the function itself :
- (a)  $\sin x$
  - (b)  $\log (x)$
  - (c)  $\exp (x)$
  - (d)  $k \cdot x$
42. The binary equivalent of the chemical number 11 is :
- (a) 1010
  - (b) 1011
  - (c) 1100
  - (d) 1001
43. If  $V$  is the actual volume of a gas molecule, its effective volume is :
- (a)  $4 V$
  - (b)  $2 V$
  - (c)  $V$
  - (d)  $8 V$

44. At a pressure  $P$  the collision frequency and mean free path of molecules in a gas are  $n$  and  $l$ . If the pressure is reduced to  $p/3$ , keeping the temperature constant, the new values of  $n$  and  $l$  will be :
- (a)  $3n, 3l$
  - (b)  $3n, \frac{l}{3}$
  - (c)  $\frac{n}{3}, l$
  - (d)  $\frac{n}{3}, 3l$
45. Liquid crystals can be distinguished by the arrangement of molecules in the liquid. Which of the liquid phases shows a stacked helical structure :
- (a) Nematic
  - (b) Smectic
  - (c) Cholesteric
  - (d) Both (a) and (b)
46. The Miller index of a diagonal plane that divides a cubic unit cell into two equal prisms is :
- (a) 101
  - (b) 111
  - (c) 100
  - (d) 210
47. The slope of the plot of  $\ln k$  vs  $\frac{1}{T}$  of decomposition of acetaldehyde was found to be  $-2.27 \times 10^4 \text{K}$ . What is the approximate activation energy of the reaction ?
- (a) 190 kJ/mol
  - (b) 380 kJ/mol
  - (c) 100 kJ/mol
  - (d) 95 kJ/mol

48. Two moles of an ideal gas are heated at constant volume from  $100^{\circ}\text{C}$  to  $200^{\circ}\text{C}$ . The change in its internal energy will be :
- (a) 100 R
  - (b) 200 R
  - (c) 150 R
  - (d) 300 R
49. An adiabatic process is :
- (a) isobaric
  - (b) isochoric
  - (c) isenthalpic
  - (d) isentropic
50. A Carnot engine with an efficiency of 80% is operating between a sink and a source at  $150^{\circ}$ . The temperature of the sink is :
- (a)  $100^{\circ}\text{C}$
  - (b)  $80^{\circ}\text{C}$
  - (c)  $50^{\circ}\text{C}$
  - (d)  $30^{\circ}\text{C}$
51. One mole of oxygen is mixed with 2 moles of Hydrogen under standard temperature and pressure. The accompanying entropy change is :
- (a) Zero
  - (b)  $16 \text{ JK}^{-1}$
  - (c)  $10 \text{ JK}^{-1}$
  - (d)  $30 \text{ JK}^{-1}$
52. Which of the following thermodynamic functions represents the arrow of the time ?
- (a) H
  - (b) A
  - (c) S
  - (d) G

53. The equilibrium constant of the reaction :



is 0.608 at 500 K. Equilibrium constant of the reverse reaction would be :

- (a) 1.64
- (b) 0.392
- (c) 3.98
- (d) 0.608

54. Absolute alcohol cannot be obtained by fractional distillation of industrial alcohol because :

- (a) Alcohol and water are completely miscible
- (b) Alcohol forms hydrogen bonds with water
- (c) Alcohol and water forms an azeotropic mixture
- (d) None of the above

55. The solubility product of a sparingly soluble salt in water is  $4 \times 10^{-12} \text{ dm}^9 \text{ mol}^{-3}$ . Its solubility at the given temperature is :

- (a)  $4 \times 10^{-12} \text{ mol/dm}^3$
- (b)  $2 \times 10^{-6} \text{ mol/dm}^3$
- (c)  $1 \times 10^{-4} \text{ mol/dm}^3$
- (d)  $1.58 \times 10^{-4} \text{ mol/dm}^3$

56. The electrode potential of the half cell



is :

- (a)  $\frac{2.3 RT}{F}$
- (b)  $-\frac{2.3 RT}{F}$
- (c)  $\frac{RT}{F}$
- (d)  $-\frac{RT}{F}$

57. A quantum mechanical operator must be :
- (a) Hamiltonian
  - (b) Commutative
  - (c) Hermitian
  - (d) All of the above
58. Which of the following molecules will *not* give rotational spectrum ?
- (a)  $\text{CO}_2$
  - (b)  $\text{HCl}$
  - (c)  $\text{H}_2\text{O}$
  - (d)  $\text{NO}$
59. The absorbance  $A$  and the transmittance  $T$  of light in a medium are related as :
- (a)  $A = 1 - T$
  - (b)  $A = -\log T$
  - (c)  $A = \log T$
  - (d)  $T = -\log A$
60. The freezing point of a solution of  $\text{NaNO}_3$  prepared by dissolving 2.83 g in 100 g of water is :
- (a)  $-0.52^\circ\text{C}$
  - (b)  $-1.0^\circ\text{C}$
  - (c)  $-1.24^\circ\text{C}$
  - (d)  $-2.0^\circ\text{C}$