

CHEMISTRY
(Inorganic Chemistry)

1. Which quantum number exhibits Zeeman effect ?
 - (A) Principal quantum number
 - (B) Azimuthal quantum number
 - (C) Magnetic quantum number
 - (D) Spin quantum number

2. LiF is insoluble in water while LiI is soluble because ?
 - (A) Fluoride is more electronegative than iodide
 - (B) Size of iodide is greater than that of fluoride
 - (C) The internuclear distance in LiF is smaller than that in LiI
 - (D) Lattice energy of LiF is more than that of LiI

3. Which one of the following factors would decrease the stability of clathrates ?
 - (A) The guest molecules are tightly held in the cavities of host molecules
 - (B) The guest molecules within the cavities are at maximum potential energy
 - (C) The guest molecules within the cavities are at minimum potential energy
 - (D) The size of guest molecules fits into the cavities of host molecules

4. VCl_2 is ionic, VCl_3 is less ionic, while VCl_4 is covalent, because ?
 - (A) With increase in oxidation state of a given transition metal, the ionic character of its compound increases
 - (B) With the increase in oxidation state of a given transition metal, the covalent character of its compound increases
 - (C) With the decrease in oxidation state of a given transition metal, the covalent character of its compound increases.
 - (D) With the decrease in oxidation state of given transition metal, the ionic character of its compound decreases

5. Which one of the following statements is *not* correct ?
- (A) In lanthanides, the additional electron enters $4f$ orbitals
 - (B) The mutual shielding effect between two electrons residing in $5f$ orbitals (actinides) is poor
 - (C) Actinides form complexes with π -bonding ligands
 - (D) The compounds of lanthanides are more basic
6. The isotope that finds use in the pressure vessels for nuclear reactors is :
- (A) ${}_{16}^{35}\text{S}$
 - (B) ${}_{34}^{74}\text{Se}$
 - (C) ${}_{53}^{131}\text{I}$
 - (D) ${}_{27}^{60}\text{Co}$
7. The element which is required in trace amount by the living organism is :
- (A) Mn
 - (B) Mo
 - (C) Al
 - (D) Zn
8. The compound which is used as red phosphorus in television and computer-terminal display is :
- (A) Xenotime
 - (B) Uranite
 - (C) Monazite
 - (D) Europium oxide

9. The Fe^{2+} changes from high spin to low spin state during its conversion from deoxyhaemoglobin to oxyhaemoglobin, this results in a decrease in its size by :
- (A) 22%
 (B) 25%
 (C) 33%
 (D) 36%
10. The orbitals of the central metal which will hybridize to give a complex of trigonal bipyramidal geometry is :
- (A) $d_{x^2-y^2}, d_{z^2}, s, p^3$
 (B) $d_{xy}, d_{x^2-y^2}, d_{z^2}, s, p^2$
 (C) d_{xy}, s, p^3
 (D) $d_{xy}, d_{z^2}, d_{x^2-y^2}, p^3$
11. The normality of 70% (w/w) HNO_3 having specific gravity of 1.40 will be :
- (A) 7.00 N
 (B) 11.11 N
 (C) 15.56 N
 (D) 15.77 N
12. The oxyacid of chlorine which has the pK_{a2} value equal to that of pK_{a1} of H_2SO_4 is :
- (A) HClO
 (B) HClO_2
 (C) HClO_3
 (D) HClO_4

13. Sodium sesqui-carbonate is represented by the formula :
- (A) NaHCO_3
 - (B) $\text{Na}_2\text{CO}_3\text{—H}_2\text{O}$
 - (C) $\text{Na}_2\text{CO}_3\text{—}10\text{H}_2\text{O}$
 - (D) $\text{Na}_2\text{CO}_3\text{—NaHCO}_3 \cdot 2\text{H}_2\text{O}$
14. Sodium iodide (Iodine-131, half life — 8.05 days) is used in the treatment of thyroid cancer. If one begins with 25.0 mg of Na^{131}I , the number of milligrams of radioactive material remaining after about a month (32.2 days) will be :
- (A) 6.25
 - (B) 1.56
 - (C) 3.12
 - (D) 0.78
15. The complex that violates the EAN rules is :
- (A) Potassium ferricyanide
 - (B) Potassium ferrocyanide
 - (C) Nickel carbonyl
 - (D) Cobalt hexamine chloride

16. EDTA forms stable complexes with divalent metals in :
- (A) Acidic medium
 - (B) Ammonical solution
 - (C) Aqueous medium
 - (D) All of the above
17. According to autoionisation concept, acetic acid in liquid ammonia is a :
- (A) weak acid
 - (B) base
 - (C) strong base
 - (D) strong acid
18. Which among the following will be classified as the softest base ?
- (A) H^-
 - (B) OH^-
 - (C) O^{2-}
 - (D) $SS_2O_3^{2-}$
19. The lanthanide element which *does not* occur in nature, is :
- (A) Dysprosium
 - (B) Praseodymium
 - (C) Promethium
 - (D) Neodymium

20. The metal which is involved in the formation of oxygen during photosynthesis in green plants is :

(A) Mg

(B) Ca

(C) Mn

(D) Fe

(Organic Chemistry)

21. Alkaline hydrolysis of 2-bromo, 2-ethyl pentane yields of opposite stereochemistry. This is due to :

(A) inversion

(B) racemisation

(C) retention

(D) oxidation

22. The major product of the reaction between 2-bromo, 2-methyl butane and sodium ethoxide in the presence of ethyl alcohol is :

(A) 2-methyl butanol

(B) 2-methyl, 2-butene

(C) 2-methyl, 1-butene

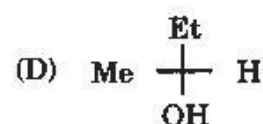
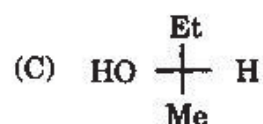
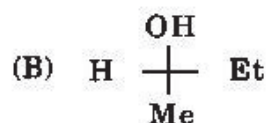
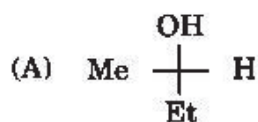
(D) 2-hydroxy, 2-methyl butane

23. Phenol on treatment with acetic anhydride in the presence of aqueous NaOH, gives phenyl acetate, which on heating with AlCl_3 gives a mixture of ortho and para-hydroxy acetophenone. The name of reaction involved, is :
- (A) Fries rearrangement
 - (B) Friedel-Crafts Alkylation
 - (C) Friedel-Crafts Acylation
 - (D) Fischer Indole Reaction
24. Which of the following compounds will *not* be a reduction product of Nitrobenzene in acidic, alkaline and neutral medium ?
- (A) Aniline
 - (B) Phenyl hydroxylamine
 - (C) Azobenzene
 - (D) P-aminophenol
25. Which amongst the following methods for the preparation of 1° amines involves intermediate formation of a nitrene with a descent of a homologous series ?
- (A) Gabriel's phthalimide reaction
 - (B) Hoffman bromide reaction
 - (C) Reductive amination of acetaldehyde or acetone
 - (D) Azo-coupling

26. Which amongst the following name reactions is *not* a method for the preparation of nitrogen heterocyclics ?
- (A) Skraup's synthesis
 - (B) Bischler—Napieralski reaction
 - (C) Fischer Indole synthesis
 - (D) Hell Volhard Zelinsky reaction
27. Glucose displays mutarotation due to the presence of :
- (A) Asymmetric carbon
 - (B) Hemiacetal formation
 - (C) Anomeric centre
 - (D) Acetal formation
28. When treated with sodium ethoxide in ethanol at 25°C, which of the following alkyl bromides would give predominantly elimination product ?
- (A) $\text{CH}_3\text{CH}_2\text{Br}$
 - (B) $(\text{CH}_3)_2\text{CHBr}$
 - (C) $(\text{CH}_3)_3\text{CBr}$
 - (D) $(\text{CH}_3)_3\text{CCH}_2\text{Br}$
29. Which of the following stereochemical relationship exists between alpha and beta-D-glucopyranoses ?
- (A) Enantiomeric
 - (B) Anomeric
 - (C) Epimeric
 - (D) Diastereoisomeric

30. Which amongst the following conjugated proteins has cholesterol as a non-amino acid residue ?
- (A) Glycoproteins
 - (B) Phosphoproteins
 - (C) Nucleoproteins
 - (D) Lipoproteins
31. Which amongst the following drugs has anti-inflammatory action ?
- (A) Phenylbutazone
 - (B) Aspirin
 - (C) Paracetamol
 - (D) Sulphapyridine
32. Which of the following is the *correct* order of decreasing nucleophilic strength of different halides ?
- (A) $I^{\ominus} > F^{\ominus} > Cl^{\ominus} > Br^{\ominus}$
 - (B) $I^{\ominus} > Br^{\ominus} > Cl^{\ominus} > F^{\ominus}$
 - (C) $I^{\ominus} > Cl^{\ominus} > Br^{\ominus} > F^{\ominus}$
 - (D) $I^{\ominus} > Cl^{\ominus} > F^{\ominus} > Br^{\ominus}$
33. How many geometrical isomers are possible for 2, 4-hexadiene ?
- (A) None
 - (B) Two
 - (C) Four
 - (D) Six

34. Which of the following Fischer Projection formula is that of (R) 2-butanol?



35. Methylcyclohexane exists in two conformational forms which are rapidly converting into one another. The ratio of methylcyclohexanes having methyl equatorial and methyl axial at equilibrium is :

(A) 50 : 50

(B) 95 : 6

(C) 5 : 95

(D) 40 : 60

36. The relative rates of reaction of alkyl halides CH_3X , $\text{CH}_3\text{CH}_2\text{X}$, $(\text{CH}_3)_2\text{CHX}$ and $(\text{CH}_3)_3\text{CX}$ are randomly given below. Which of them you would attribute to CH_3X :

(A) Zero

(B) 0.02

(C) 1.00

(D) 30

37. Which of the following sugars *does not* respond to either Tollen's, Benedict's or Fehling's tests ?
- (A) Maltose
 - (B) Cellobiose
 - (C) Sucrose
 - (D) Fructose
38. The methyl protons in the nmr spectrum of toluene appear at σ :
- (A) 2.30 as doublet
 - (B) 0.9 as singlet
 - (C) 5.0 as singlet
 - (D) 2.30 as singlet
39. The range of fingerprint regions in the infrared spectrum lies between :
- (A) 666—1444 cm^{-1}
 - (B) 1650—1800 cm^{-1}
 - (C) 3300—3610 cm^{-1}
 - (D) 1050—1400 cm^{-1}
40. A neat sample of ethanol at -40°C , will display the following multiplicity in proton magnetic spectra :
- (A) Triplet, quarter
 - (B) Triplet, multiplet, triplet
 - (C) Double doublet
 - (D) Triplet, quartet, triplet

(Physical Chemistry)

41. The slope of a line whose inclination is 45° will be :
- (A) 1
 - (B) $\sqrt{3}$
 - (C) $1/\sqrt{3}$
 - (D) $\sqrt{2}$
42. The decimal equivalent of the binary number $(1101)_2$ is :
- (A) $(53)_{10}$
 - (B) $(13)_{10}$
 - (C) $(54)_{10}$
 - (D) $(4)_{10}$
43. The temperature at which a real gas shows ideal behaviour is known as :
- (A) Critical temperature
 - (B) Inversion temperature
 - (C) Boyle's temperature
 - (D) Charles temperature
44. The values of the van der Waals' constants " a " for the gases A_2 , B_2 , C_2 and D_2 are 2, 3, 4 and $5 \text{ dm}^3 \text{ atm mol}^{-2}$ respectively. The gas which can be most easily liquefied is :
- (A) A_2
 - (B) B_2
 - (C) C_2
 - (D) D_2

45. The Miller indices of a crystal plane which cuts through crystal axes at $6a$, $3b$, $3c$ are :
- (A) 326
 - (B) 111
 - (C) 122
 - (D) 211
46. The rate law for the reaction $A + 2B \rightarrow \text{Products}$ is, $\text{rate} = k [A] [B]^2$. If B is present in large excess, then the order of the reaction will be :
- (A) 2
 - (B) 1
 - (C) 3
 - (D) 0
47. The probability factor existing in the collision theory of reaction rates is related to which of the following thermodynamic parameters.
- (A) Enthalpy of activation
 - (B) Entropy of activation
 - (C) Gibbs free energy of activation
 - (D) Helmholtz free energy of activation
48. Which of the following thermodynamic functions is *not* equal to zero for an element in its most stable form ?
- (A) Standard enthalpy
 - (B) Standard Gibbs free energy
 - (C) Standard entropy
 - (D) Standard Helmholtz free energy

49. For an ideal gas, Joule-Thomson coefficient is :
- positive
 - negative
 - zero
 - unity
50. At the triple point in the phase diagram of a one component system, which of the following is *correct* ?
- Three components are in equilibrium
 - The number of degrees of freedom is zero
 - The number of degrees of freedom is three
 - The number of degrees of freedom is one
51. The number of components, number of phases and the degrees of freedom for the system $\text{CaCO}_{3(s)} \rightleftharpoons \text{CaO(s)} + \text{CO}_2(\text{g})$.
- 1, 3, 0
 - 2, 1, 3
 - 1, 1, 2
 - 2, 3, 1
52. The molar conductivity of a given solution of MgCl_2 at infinite dilution, given that $\sqrt{\alpha} \text{ Mg}^{2+} = 106 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ and $\sqrt{\alpha} \text{ Cl}^- = 76 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$, will be :
- $25.8 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$
 - $2.58 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$
 - $258 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$
 - $182 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$

53. The molar conductance of a weak electrolyte at room temperature is $1 \times 10^{-6} \text{ Sm}^2$ and the molar conductance at infinite dilution is $500 \text{ Sm}^2 \text{ mol}^{-1}$. The degree of dissociation of the electrolyte is :
- (A) 1×10^{-9}
(B) 1×10^{-8}
(C) 2×10^{-8}
(D) 2×10^{-9}
54. For which values of "n", the principal quantum number, the wave functions for a particle in one-dimensional box are symmetric ?
- (A) Odd values of n
(B) Even values of n
(C) Zero values of n
(D) All values of n
55. The operator for the potential energy of electron in hydrogen atom is :
- (A) e^2/r
(B) $-e^2/r$
(C) $2e^2/r$
(D) $-e^2/2r$
56. The molecular orbital which has two nodal planes amongst the following is :
- (A) σ_{1s}
(B) σ_{2pz}
(C) π_{Px}
(D) π_{2Px}^*

57. Which of the following molecules is said to be microwave inactive but infra-red active ?
- (A) HCl
 - (B) H₂
 - (C) CO₂
 - (D) O₂
58. The transitions which are usually non-radioactive involve :
- (A) Internal conversion
 - (B) Fluorescence
 - (C) Phosphorescence
 - (D) Chemiluminescence
59. In which of the following molecules, the molar polarization will be independent of temperature :
- (A) HCl
 - (B) CH₃Cl
 - (C) CO
 - (D) CH₄
60. Cryoscopic constant is a characteristic of :
- (A) solute
 - (B) solvent
 - (C) solution
 - (D) both solute and solvent