

CHEMISTRY VOLUME I

Time Allowed: 3 Hours

Max Marks: 150

PART - I

Note: Answer all the Questions

(30X1=30)

Choose and write the correct answer

- Dual character of an electron was explained by
(a) Bohr (b) Heisenberg (c) de-broglie (d) Pauli
- Hybridisation of carbon in acetylene is
(a) sp (b) sp² (c) sp³ (d) sp³d
- An example for dsp² hybridisation is
(a) PF₅ (b) SF₆ (c) IF₇ (d) [Pt Cl₄]²⁻
- The strength of H-bond is in the order of
(a) H-F...H > H-O...H > H-N...H (b) H-F...H < H-O...H < H-N...H
(c) H-N...H > H-F...H > H-O...H (d) H-O...H > H-N...H > N-O...H
- The geometry of IF₇ is
(a) heptagonal (b) octahedral (c) trigonal bipyramidal (d) pentagonal bipyramidal
- The orbital configuration of a certain homonuclear species is (σ_{1s})² (σ*_{1s})² (σ_{2s})² (σ*_{2s})² (π_{2p})¹. The bond order will be
(a) 1/2 (b) 2 (c) 3 (d) Zero
- The value of C-C distance found experimentally in a saturated hydrocarbon is
(a) 1.34Å (b) 1.36Å (c) 1.54Å (d) 1.56Å
- Effective nuclear charge (Z*) can be calculated using the formula
(a) Z* = Z - S (b) Z* = Z + S (c) Z* = S - Z (d) Z = Z* - S
- The correct order of size among Cl, Cl⁺ and Cl⁻ is
(a) Cl⁺ < Cl < Cl⁻ (b) Cl⁺ > Cl > Cl⁻ (c) Cl⁺ < Cl < Cl⁻ (d) Cl⁻ < Cl < Cl⁺
- The electronegativities of the following elements increase in the order
(a) C, N, Si, P (b) N, Si, C, P (c) Si, P, C, N (d) P, Si, N, C
- The X_B - X_A = 0 then A-B bond is
(a) Polar (b) Non-polar (c) Ionic (d) Metallic
- The correct order of electron affinities of halogen is
(a) F > Cl > Br > I (b) I > Br > Cl > F (c) Cl > F > Br > I (d) Cl > F > Br < I
- The compound with garlic odour is
(a) P₂O₃ (b) P₂O₅ (c) H₃PO₃ (d) H₃PO₄
- Among the halogen acid, the weakest acid is
(a) HF (b) HCl (c) HBr (d) HI
- Red lead is
(a) PbO (b) Pb₃O₄ (c) Pb O₂ (d) Pb O. PbO₂
- PCl₃ is purified by
(a) Recrystallisation from H₂O (b) Sublimation
(c) Recrystallisation from CS₂ (d) Distillation over white P
- The acid that reduces Ag NO₃ to Ag is
(a) HPO₃ (b) H₃PO₄ (c) H₄P₂O₇ (d) H₃PO₃
- Holme's signal involves a mixture
(a) Silicon carbide and calcium phosphide
(b) Copper phosphide and calcium phosphide
(c) Calcium phosphide and calcium carbide
(d) Silicon carbide and copper phosphide
- "Chalcogens" are elements belonging to
(a) Carbon family (b) Halogen family (c) Nitrogen family (d) Oxygen family
- Glass is attacked by
(a) HF (b) HCl (c) HBr (d) HI

21. The colour of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ ion is due to
 (a) d-d transition (b) presence of water molecules
 (c) Inter atomic transfer of electron (d) None of the above
22. The correct electronic configuration of copper atom is
 (a) $3d^{10}4s^1$ (b) $3d^{10}4s^2$ (c) $3d^94s^2$ (d) $3d^54s^24p^4$
23. In the extraction of Cu, the reaction which take place is the Bessemer convertor is
 (a) $2\text{CuFeS}_2 + \text{O}_2 \rightarrow \text{Cu}_2\text{S} + \text{FeS} + \text{O}_2$ (b) $2\text{Cu}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{Cu}_2\text{O} + 2\text{SO}_2$
 (c) $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \rightarrow 6\text{Cu} + \text{SO}_2$ (d) $2\text{FeS} + 3\text{O}_2 \rightarrow 2\text{FeO} + 2\text{SO}_2$
24. The element showing oxidation state of +2, +3, +4, +6 and +7 is
 (a) V (b) Mn (c) Cr (d) Cu
25. Sc^{3+} and Ti^{4+} are colourless because they have
 (a) $3d^0$ configuration (b) $3d^2$ configuration
 (c) $3d^5$ configuration (d) $3d^6$ configuration
26. Calomel is used in medicine as
 (a) eye-lotion (b) skin ointment (c) tonic (d) purgative
27. An example of an ambidentate ligand is
 (a) CN^- (b) Cl^- (c) NO_2^- (d) I^-
28. The name of $[\text{Pt}^{iv}(\text{NH}_3)_2\text{Cl}_2]^{2+}$ is
 (a) Diamminedichloroplatinum (IV) ion (b) Diamminedichloroplanitate (IV)
 (c) Diamminedichloroplatinum (d) Dichlorodiammineplatinum (IV) ion
29. Pentaammine bromo cobalt (III) Sulphate and Pentaammine sulphate Cobalt (III) bromide are example of _____ Isomerism
 (a) Co-ordination (b) Ionisation (c) Solvate (d) Linkage
30. Loss of a β -particle is equivalent to
 (a) Increase of one proton only (b) Decrease of one neutron only
 (c) Both (a) and (b) (d) None of these

PART - II

Note:

(15X3 = 45)

(i) Answer any 15 questions.

(ii) Answer in one or two sentences:

31. Define reaction quotient ?
32. Mention the disadvantage of Pauling Scale.
33. What is plumbo solvency ?
34. How will you calculate the number of atoms in BCC system.
35. Why transition elements form complexes ?
36. Define standard free energy ?
37. What are chelates ? Give one example.
38. Define entropy of a system?
39. Why is ionization energy of oxygen is less than nitrogen ?
40. H_3PO_3 is diprotic. Why ?
41. Write a note about etching of glass.
42. Explain why d-block elements exhibit various oxidation states.
43. Explain - chrome plating
44. Write Bragg's equation ?
45. Write a short note on metallic crystals.
46. Which element of the following has highest ionisation potential ? Na, Cl, Si and Ar.
47. Prove that P_2O_5 is a powerful dehydrating agent.
48. Why Zn^{2+} salts are white while Ni^{2+} salts are coloured ?
49. Write two alloys of copper and their uses.
50. Give one example for a monodentate ligand, a bidentate ligand and a chelating ligand.
51. State Le Chatelier's principle.

PART - III

Note:

(7X5 = 35)

(i) Answer any Seven questions choosing at least two questions from each section.

Section - A

52. Explain the formation of oxygen molecule by molecular orbital theory.
53. Describe the extraction of Lanthanides from monazite sand.

54. $[Ni(CN)_4]^{2-}$ is diamagnetic whereas $[NiCl_4]^{2-}$ is para magnetic. Explain.
 55. State and explain Le chatelier -Braun principle.

Section - B

56. Derive Vant Hoff equation.
 57. Using valence bond theory explain by hybridisation and magnetic property in
 (i) $[FeF_6]^{4-}$ and (ii) $[Fe(CN)_6]^{4-}$
 58. Explain the different types of hydrogen bonds with suitable examples.
 59. How chlorophyll is important in environmental chemistry? Mention its function.

Section - C

60. What is lanthanide contraction? Discuss the consequences and uses.
 61. Derive the relation between ΔG and ΔS .
 62. Derive de - Broglie's equation. What is its significance?
 63. Explain the extraction of Zinc from its ore.

PART - IV

Note: (4X10 = 40)
Answer question number 70 and any three from the remaining questions.

64. (a) Discuss the Davisson and Germer experiment.
 (b) Discuss the shapes of s, p and d orbitals.
 65. (a) Explain Pauling method to determine ionic radii.
 (b) Explain the various factors that affect electron affinity.
 66. (a) Explain brief the extraction of copper from its chief ore.
 (b) List the ores of silver. How silver is extracted from Argentite?
 67. (a) Discuss the position of lanthanides in the periodic table.
 (b) Give various statements of second law of thermodynamics.
 68. (a) For the complexes $K_4[Fe(CN)_6]$, $[Cu(NH_3)_4]SO_4$ mention
 (A) Name (B) Central metal ion (C) Ligands (D) Coordination number
 (b) $[Cu(NH_3)_4]^{2+}$ is square planar, where as $[NiCl_4]^{2-}$ is tetrahedral. Explain.
 69. (a) Describe the different imperfections in solids.
 (b) Complete the following
 (i) ${}_7N^{14} + {}_2He^4 \rightarrow {}_8O^{17} + \underline{\hspace{2cm}}$
 (ii) ${}_{92}U^{235} + {}_0n^1 \rightarrow {}_{56}Ba^{137} + {}_{36}Kr^{93} + \underline{\hspace{2cm}}$
 (iii) ${}_{29}Cu^{53} \rightarrow {}_{28}Ni^{53} + \underline{\hspace{2cm}}$
 (iv) $2 {}_1H^3 \rightarrow {}_2He^4 + \underline{\hspace{2cm}}$
 70. (a) An element **A** occupies group number 16 and period number 3, known as brim stone. This element gives compound **B** by contact process. Compound **B** is known as the king of chemicals. Compound **B** is a drying and dehydrating agent. Identify the element **A** and the compound **B**. Write the reactions.
 (b) An element **A** occupies group number 17 and period number 2, shows anomalous behaviour. **A** reacts with water forms a mixture of **B**, **C** and acid **D**. **B** and **C** are allotropes. **A** also reacts with hydrogen violently even in dark to give an acid **D**. Identify **A**, **B**, **C**. Write the reactions.
 (OR)
 (c) In the equilibrium $H_2 + I_2 = 2HI$ The no of moles of H_2, I_2 and HI are 1,2,3 moles respectively. Total pressure is 60 atm. Calculate the partial pressure of H_2, I_2 and HI in the mixture.
 (d) An element **A** occupies group number 17 and period number 2, is the most electronegative element it reacts with Another element **B** belongs to group number 17 and period number 4, to give a compound **C**. Compound **C** undergoes sp^3d^2 hybridisation and has octahedral structure. Identify the elements **A** and **B** and the compound **C**. Write the reactions.