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Subject Title: Chemistry III

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**Unit - I: INORGANIC CHEMISTRY**

1. Write the names of the following coordination compounds  
a)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$     b)  $\text{K}_3[\text{Fe}(\text{CN})_6]$     c)  $[\text{Pt}(\text{en})_2\text{Cl}_2](\text{NO}_3)_2$     d)  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]$
2. Discuss the classification of organometallic compounds with examples?
3. Discuss the formation of  $[\text{NiCl}_4]^{2-}$ ,  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  and  $[\text{Fe}(\text{CN})_6]^{3-}$  on the basis of valence bond theory (VBT) ?  
ii) What is 18 valence electron rule? Explain with two examples?
4. Explain the postulates of Werner's co-ordination theory taking suitable examples?
5. Describe Sidgwick electronic interpretation of coordination compound and EAN rule and their limitations?
6. What is effective atomic number? Calculate EAN of the central ion in the following: i)  $\text{K}_4[\text{Fe}(\text{CN})_6]$  ii)  $\text{K}_2[\text{TiCl}_6]$  iii)  $[\text{Pd}(\text{NH}_3)_6]^{2+}$  iv)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  v)  $[\text{Ag}(\text{NH}_3)_2]^+$
7. i) Write about the postulates of Valence Bond Theory (VBT) and its drawbacks?  
ii) Explain the limitations of Valence Bond Theory (VBT)?
8. Explain Inner and Outer Orbital Complexes with suitable examples?
9. Explain structural isomerism with suitable examples?
10. How does valence bond theory account for the fact that  $[\text{NiCl}_4]^{2-}$  is paramagnetic while  $\text{Ni}(\text{CO})_4$  is diamagnetic?
11. What is meant by stereoisomerism in co-ordination compounds? Explain with suitable examples?
12. a) Why square planar complexes do not exhibit optical isomerism?  
b) Draw all possible isomers of each of the following:  
i)  $[\text{Co}(\text{NH}_3)_2\text{Cl}_2]^+$     ii)  $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$     iii)  $[\text{Pt}(\text{H}_2\text{O})_2\text{Br}_2]$     iv)  $[\text{Pt}(\text{en})\text{Br}_2\text{Cl}_2]$     v)  $[\text{Co}(\text{en})_3]\text{Cl}_3$

13. Write the preparation of Lithium Organometallic Compounds and its properties?
14. Write the preparation of Mg organometallic compounds and explain its properties?
15. What are aluminum organometallic compounds? Write the preparation of alkyl aluminum organometallic compounds and its properties?
16. Write the preparation of aryl aluminum organometallic compounds with suitable examples and its properties?
17. How does the structure of  $\text{Fe}_2(\text{CO})_9$  differ from that of  $\text{Mn}_2(\text{CO})_{10}$  ?
18. What are metal carbonyls? Give the classification of metal carbonyls?
19. Describe the structure and shape of metal carbonyls with suitable examples?
20. Explain the preparation and properties of nickel carbonyl  $[\text{Ni}(\text{CO})_4]$  ?
21. Explain and draw the structure of  $\text{Fe}_3(\text{CO})_{12}$  and  $\text{Fe}_2(\text{CO})_9$  ?

## Unit - II: ORGANIC CHEMISTRY

22. Why are carboxylic acids stronger acids than phenols? Explain.
23. Give any two methods for the preparation of nitroalkanes?
24. Write a note on :
  - i) Huns Diecker reaction    ii) Smidt reaction    iii) Hell-Volhard-Zelensky reaction
25. Write the reduction reactions of nitrobenzene in alkaline and acidic medium?
26. Explain why benzoic acid is stronger than acetic acid?
27. Write a note on Hoffmann bromamide reaction?
28. Explain the preparation of carboxylic acids with mechanism by using following methods:
  - a) Hydrolysis of nitriles    b) Hydrolysis of acid chlorides or amides    c) Hydrolysis of esters
  - d) Carbonation of Grignard's reagent    e) Basic catalyzed hydrolysis
29. Write the mechanism involved in the esterification of carboxylic acids with alcohols?
30. Explain the preparation of aromatic acids by using following special methods, a)Oxidation of side chain (From alkyl benzenes)    b)Hydrolysis by benzotrichlorid c)Kolbe's reaction
31. Write a note on NEF reaction?

32. Explain the reactivity of nitroalkanes in case of a) Halogenation b) Reaction with  $\text{HNO}_2$
33. Explain the mechanism of Arndt Eistert synthesis with suitable example?
34. Give a brief account on the following chemical reactions :
- (a) Reduction (b) HVZ
35. Nitroalkanes yields products when reduced with the following reducing agents.
- a)  $\text{Ni/LiAlH}_4$  b)  $\text{Zn/NH}_4\text{Cl}$
36. Write the products obtained in the following reactions:
- a) Nitrobenzene +  $\text{SnCl}_2 + \text{HCl} \rightarrow$
- b) 2 Nitrobenzene +  $\text{SnCl}_2 + \text{NaOH} \rightarrow$
37. i) Explain degradation of carboxylic acid?
- ii) Write a short note on Inductive Effect?

### Unit - III: PHYSICAL CHEMISTRY

38. Define the Following terms – Isolated system, Extensive Properties, Intensive Properties?
39. Write a note on Enthalp and Entropy?
40. Give a note on Reversible and Irreversible Process?
41. State and Explain First Law Of Thermodynamics?
42. Define and Explain Internal Energy in different Paths?
43. Define Heat Capacity of system. Explain the relationship between  $C_p$  &  $C_v$  in Gaseous System?
44. Explain the work done in Isothermal Reversible Expansion of an Ideal Gas?
45. State and Explain Joule Thomson Coefficient?
46. Derive an expression for Adiabatic Process and Work done in Adiabatic Process?
47. Derive Kirchoff's Equation and Mention its Applications?
48. Explain and Derive Carnot's Cycle and efficiency of Heat engine?
49. Write briefly the significance of Gibb's Helmholtz equation?
50. State Second law of thermodynamics in any two different forms?
51. Explain the significance of Entropy?
52. Derive the expression  $PV^\gamma = \text{constant}$ ?
53. What is Gibb's free energy and significance?

54. Depict PV –curves for isothermal and adiabatic process ?
55. Derivation of Gibb's free energy equation and its significance?
56. Maxwell's relations and Variation of G with P, V, T?
57. Define Path Function and State Function?
58. Explain Entropy changes in Reversible isothermal process and reversible adiabatic process?

#### **Unit - IV: GENERAL CHEMISTRY**

59. Define the terms, significant figures, accuracy, and precision?
60. Explain the classification of Errors-Absolute and Relative Errors?
61. Write the reactions and mechanisms of Aldol, Perkin, and Benzoin condensation?
62. Explain the phase rule of two component system with example?
63. What is eutectic point and Triple point?
64. Construct phase diagram of temperature V/S composition for Zn –Mg and Explain the curves?
65. Discuss the applications of phase rule of Pb-Ag system?
66. Define the terms involved in phase rule with examples?
67. Discuss the use of phase rule in Pattinson's process for desilverisation of Pb?
68. Explain Congruent melting point-Mg-Zn system?
69. Explain Incongruent melting point system using NaCl-Water system?
70. Explain one component system?
71. Explain the tautomerism in Nitro-hydrocarbons, Ethylacetoacetate, Diethyl malonate ?
72. Explain the tautomerism in Terminal alkynes?