2024/11

SET A

B.Sc. CHEMISTRY
FIFTH SEMESTER
INORGANIC CHEMISTRY-IV
BSC - 501

[USE OMR FOR OBJECTIVE PART]

Duration : 3 hrs. **Full Marks : 70**

(PART-A: Objective)

Time : 30 min. **Marks : 20**

Choose the correct answer from the following: ***1×20=20***

1. The formula for the complex tetraamminedichloridocobalt(III)hexacyanido chromate(III) is
   a. $[Cr(CN)_6][Co(NH_3)_4Cl_2]_3$ b. $[Co(NH_3)_4Cl_2]_3[Cr(CN)_6]_2$
   c. $[Co(NH_3)_4Cl_2][Cr(CN)_6]$ d. $[Co(NH_3)_4Cl_2]_3[Cr(CN)_6]$

2. Trimethylaluminium exists as
   a. $Al(CH_3)_3$ b. $Al_2(CH_3)_6$
   c. Al_2Cl_6 d. $Al(C_2H_5)_6$

3. How many stereoisomers are shown by $FeCl_3F_3$ complex?
   a. 1 b. 2
   c. 3 d. 4

4. Zeigler-Natta catalyst is
   a. a solution of $Al(C_2H_5)_3$ in aqueous solution b. a solution of $Al(C_2H_5)_3$ and $TiCl_4$ in hydrocarbon solvent
   c. a solution of $TiCl_4$ in hydrocarbon solvent d. $AlCl_3$ in aqueous solution

5. How many chelate rings are present in potassium tris(oxalato)ferrate(III)?
   a. 2 b. 3
   c. 4 d. 6

6. Transition metal alkyl complexes are Coordination complexes that contain bond between
   a. a transition metal and an alkyl ligand b. a transition metal and an allyl ligand
   c. transition metal and a Cyclopentadienyl ligand d. transition metal and a non transition ligand

7. The CFSE value of **cobalt(II) in tetrachlorocobaltate(II)** complex is
   a. $+1.2\ \Delta_t$ b. $-1.8\Delta_t$
   c. $+2.4\Delta_t$ d. $-1.2\ \Delta_t$

8. Zeise's salt is
   a. $K[PtCl_3.C_2H_4].H_2O$ b. $K\ [PtCl_3]$
   c. $K[C_2H_4]$ d. $K[C_2H_6]$

9. Which of the following will show Jahn-Teller distortion?
   a. $[Mn(H_2O)_6]^{2+}$ b. $[Mn(H_2O)_6]^{3+}$
   c. $[Cr(H_2O)_6]^{3+}$ d. $[Fe(CN)_6]^{4-}$

10. Zeigler-Natta Polymerization is a method of
   a. Vinyl polymerization b. allyl polymerization
   c. alkyl polymerization d. Propyl polymerization

11. Zn atom in carbonic anhydrase is coordinated by three histidine and one water molecule. The reaction of CO_2 with the enzyme is an example of
   a. nucleophillic addition b. electrophilic addition
   c. electron transfer d. electrophilic substitution

12. What is the primary biological function of Hb in red blood cell?
   a. to transport glucose to cell b. to regulate body temperature
   c. to carry oxygen from lungs to tissues and CO_2 from tissues to lungs d. to synthesize protein

13. What is the structural feature that distinguishes Hemerythrin from hemoglobin?
   a. presence of heme group b. non-heme iron binding
   c. globular protein structure d. Coiled-coil motif

14. Ca bulk metal present in teeth as
   a. apatite b. hydrolases
   c. hydrogenase d. hydroxyapatite

15. What is the primary medical use of the chelating agent ethylene diamine tetra acetic acid (EDTA)?
   a. Anticoagulant for blood transfusions b. treatment of iron overload in thalassemia
   c. Chelation therapy for lead poisoning d. antibiotic treatment for bacterial infections

16. Which of the following conditions is associated with excess copper in the body?
   a. anemia and impaired immune function b. liver damage and neurological disorders
   c. increased risk of infections and poor wound healing d. osteoporosis and cardiovascular diseases

17 What is the primary target organ affected by mercury toxicity?
   a. brain b. kidneys
   c. liver d. lungs

18. What characterizes a labile complex in coordination chemistry?
   a. Slow ligand exchange rate b. Fast ligand exchange rate
   c. High thermal stability d. Low spin configuration

19. What is the typical mechanism of substitution reactions in square planar complexes?
   a. Associative b. Dissociative
   c. Interchange d. Concerted

20. Which ligand exhibits the strongest trans-effect in square planar complexes?

a. CN^- b. NO_2^-

c. Cl^- d. NH_3

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Descriptive

Time : 2 hrs. 30 min. **Marks : 50**

[Answer question no.1 & any four (4) from the rest]

1. **a.** Write the postulates of CFT? **3+3+2+2 =10**
   b. Give a brief account of hydroformylation reaction.
   c. Define trans effect with an example?
   d. Write down the mechanism of carboxypeptidase-A (CPA)?

2. **a.** Draw the structure of carbonic anhydrase (CA)? **2+2+3+3 =10**
   b. Explain how the heme group is attached to the globin protein in hemoglobin?
   c. Define the term Cytochrome? How does it classify?
   d. Draw the structure of Ferrodoxin and Riseke protein?

3. **a.** Discuss the electrostatic polarization theory of trans effect? **3+4+3 =10**
   b. Discuss the "Inner sphere mechanism" with example?
   c. Define the dissociation mechanism of octahedral complexes?

4. **a.** Write about all types of isomerism shown by coordination complexes with examples. **5+5=10**
   b. Show d-orbital splitting for Potassium tetracyanidonickelate(II) complex.

5. **a.** Explain why $B(CH_3)_3$ is an organometallic compound while $B(OCH_3)_3$ is not. **2+3+2+3 =10**
   b. Give a brief account of Zeigler-Natta Polymerization.
   c. Discuss the reaction of p-bromobenzene with n-butyl lithium.
   d. What happens when freshly prepared solution of sodium or potassium cyclopentadienide in tetrahydrofuran (THF) reacts with anhydrous ferrous chloride.

6. **a.** Describe the biological role of hemoglobin? 3+2+3+2 =10
   b. Define the term Cytochrome-450?
   c. Discuss the oxygen binding of Hemerythrin?
   d. Define the term self-exchange with an example?

7. **a.** What are the factors which affect the CFSE values? Find CFSE for the complexes $K_4[(Fe(CN)_6]$, $[Ti(H_2O)_6]^{3+}$ in terms of Δ_o. 5+2+3 =10
   b. What do you mean by chelate and macrocyclic effect?
   c. What is Jahn-Teller effect? Explain with examples.

8. **a.** Discuss the structural features of methyl lithium tetramer. 2+3+5 =10
   b. What happens when C_7H_8 is refluxed with $Mo(CO)_6$.
   c. Give an account of the structure and bonding of ferrocene.

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