

**B.SC. CHEMISTRY  
FIFTH SEMESTER  
INORGANIC CHEMISTRY- IV  
BSC – 501**  
[USE OMR FOR OBJECTIVE PART]

**SET  
A**

Duration: 3 hrs.

Full Marks: 70

Time: 30 min.

**( Objective )**

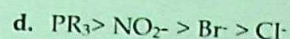
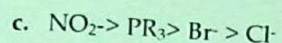
Marks: 20

*Choose the correct answer from the following:*

**1 × 20 = 20**

1.  $B(OCH_3)_3$  is
  - a. an organometallic compound
  - b. not an organometallic compound
  - c. A metallic oxide
  - d. a non-metallic oxide
2. Ziegler-Natta polymerization is
  - a. a vinyl polymerization
  - b. an allyl polymerization
  - c. a butyl polymerization
  - d. a propyl polymerization
3. Transition metal alkyl complexes are coordination compounds that contain a bond between
  - a. a transition metal and an alkyl ligand
  - b. a transition metal and a unsaturated ligand
  - c. a transition metal and cyclopentadienyl ligand
  - d. a transition metal and allyl ligand
4. Tri methyl aluminium exists as
  - a.  $Al(CH_3)_3$
  - b.  $Al_2(CH_3)_6$
  - c.  $Al_2Cl_6$
  - d.  $[AlCl_4]$
5. Non transition elements form
  - a.  $\pi$ - bonded organometallic compounds
  - b.  $\sigma$ -bonded organometallic compounds
  - c.  $\delta$ -bonded organometallic compounds
  - d. both  $\pi$ - and  $\delta$  - bonded organometallic compounds
6. Which of the following is an inhibitor of the  $Na^+/K^+$  ion pump?
  - a. Ouabain
  - b. Insulin
  - c. Glucose
  - d. ATP
7. The metal present in *carbonic anhydrase* is
  - a. Mn
  - b. Fe
  - c. Ni
  - d. Zn
8. *Carboxypeptidase* contains
  - a.  $Mg^{2+}$  and hydrolysis of  $CO_2$
  - b.  $Zn^{2+}$  and hydrolysis of  $CO_2$
  - c.  $Zn^{2+}$  and hydrolysis of peptide bond
  - d.  $Mg^{2+}$  and hydrolysis of peptide bond

9. What is the nature of active site in *ferredoxin* protein?
  - a. Heme group
  - b. Copper centre
  - c. Flavin adenine di-nucleotide
  - d. Fe-S cluster
10. What is the process by which *cytochrome c* triggers cell death?
  - a. Macrosis
  - b. Apoptosis
  - c. Mitosis
  - d. Miosis
11. Secondary valencies are satisfied by
  - a. negative ions only
  - b. neutral molecules only
  - c. either negative ions or neutral molecules or both
  - d. only water molecules
12. VBT fails to explain which of the following properties of coordination compounds?
  - a. Colour of complexes
  - b. Magnetic behaviour
  - c. Geometry of complexes
  - d. Hybridization of metal orbitals
13. The possible type of isomerism shown by  $[\text{PdI}_2(\text{ONO})_2(\text{H}_2\text{O})_2]$  is
  - a. Ionisation isomerism
  - b. Linkage isomerism
  - c. Coordination isomerism
  - d. Polymerisation isomerism
14. The hybridization of central atom in  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$  is
  - a.  $d^2sp^3$
  - b.  $sp^3d^2$
  - c.  $sp^3$
  - d.  $dsp^2$
15. Which of the following ions will have maximum crystal field stabilization energy (CFSE) in octahedral field?
  - a.  $d^3$
  - b.  $d^5$  (high-spin)
  - c.  $d^2$
  - d.  $d^9$
16. The lability order according to ionic radius will be
  - a.  $[\text{Mg}(\text{H}_2\text{O})_6]^{2+} < [\text{Ca}(\text{H}_2\text{O})_6]^{2+} < [\text{Sr}(\text{H}_2\text{O})_6]^{2+}$
  - b.  $[\text{Mg}(\text{H}_2\text{O})_6]^{2+} < [\text{Sr}(\text{H}_2\text{O})_6]^{2+} < [\text{Ca}(\text{H}_2\text{O})_6]^{2+}$
  - c.  $[\text{Mg}(\text{H}_2\text{O})_6]^{2+} < [\text{Ca}(\text{H}_2\text{O})_6]^{3+} < [\text{Sr}(\text{H}_2\text{O})_6]^{2+}$
  - d.  $[\text{Mg}(\text{H}_2\text{O})_6]^{2+} > [\text{Ca}(\text{H}_2\text{O})_6]^{2+} < [\text{Sr}(\text{H}_2\text{O})_6]^{2+}$
17. Outer orbital octahedral complexes are labile because they have ----- hybridization which has weaker bonds compared to ----- hybridization.
  - a.  $sp^3d^2$ ,  $d^2sp^3$
  - b.  $sp^3d$ ,  $dsp^3$
  - c.  $d^2sp^3$ ,  $sp^3d^2$
  - d.  $dsp^3$ ,  $sp^3d$
18. Which is the correct order of stability of halides for *class b* metals for formation of stable metal complexes?
  - a.  $\text{F}^- < \text{I}^- < \text{Cl}^- < \text{Br}^-$
  - b.  $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$
  - c.  $\text{F}^- > \text{I}^- > \text{Cl}^- > \text{Br}^-$
  - d.  $\text{F}^- > \text{Cl}^- > \text{Br}^- > \text{I}^-$
19. Identify the correct order of inertness in an octahedral complex.
  - a.  $d^6 > d^4 > d^5 > d^3$
  - b.  $d^6 > d^5 > d^4 > d^3$
  - c.  $d^6 > d^3 > d^4 > d^5$
  - d.  $d^6 > d^4 > d^5 < d^3$
20. The correct order of *trans* effecting power of leaving ligand affecting the rate of  $S_N2$  reaction is
  - a.  $\text{CN}^- > \text{PR}_3 > \text{SCN}^- > \text{H}_2\text{O}$
  - b.  $\text{SCN}^- > \text{PR}_3 > \text{CN}^- > \text{H}_2\text{O}$



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**( Descriptive )**

Time : 2 hrs. 30 min.

Marks : 50

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

1. a. Discuss the structural features of methyl lithium tetramer. 3+3+2+2  
=10  
 b. Write two biological functions of following bulk metals: (i)  $\text{Zn}^{2+}$ , (b)  $\text{Mg}^{2+}$  and (c)  $\text{Ca}^{2+}$   
 c. Find out magnetic moment of  $[\text{FeF}_6]^{3-}$  according to CFT.  
 d. Explain how bulky ligands affect the stability of complexes
  
2. a. How is trialkyl aluminium synthesised? 2+3+2+  
3=10  
 b. Discuss the structure and bonding of tri ethyl aluminium.  
 c. Outline the features of  $\sigma$ -bonded organometallic compounds.  
 d. What is Zeigler-Natta catalyst? Write down the plausible mechanism of Zeigler-Natta catalysis.
  
3. a. Define the *carbonic anhydrase*? Draw the active site structure of *carbonic anhydrase*. Write one biological role of carboxypeptidase A. 3+2+3+  
2=10  
 b. Write a short note of *rubredoxin*.  
 c. What is met-hemoglobin? How does it differ from hemoglobin?  
 d. What is the primary function of myoglobin?
  
4. a. For each of the following coordination complexes: 3+2+3+  
2=10  
 $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$ ,  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ ,  $[\text{Ni}(\text{CO})_4]$   
 i. Write the IUPAC name of each complex.  
 ii. State the primary and secondary valencies of the central metal ion in each complex.  
 iii. Calculate the Crystal Field Stabilization Energy (CFSE) for each complex.

- b. Write the differences between VBT and CFT.
5. a. "Thermodynamically stable complexes can be labile". Explain the statement with an example. 2+2+2+  
2+2=10
- b. Prove  $\beta_n = \frac{[ML_n]}{[M][L]^n}$  where M and L are metal and ligand respectively and  $\beta_n$  is the overall formation constant.
- c. Explain Irving William's order of complexes.
- d. What are *class a* metals? Explain.
- e. How does *trans effect* affect the rate of  $S_N2$  reaction in square planar complexes? Explain.
6. a. Discuss the reaction of *p*-bromo benzene with *n*-butyl lithium. 2+3+2+  
3=10
- b. What is Zeise's Compound? How was it synthesised?
- c. Define the term cooperativity in terms of hemoglobin and myoglobin?
- d. Draw the structure of *hemerythrin*. Write one biological role of *hemerythrin*.
7. a. What do you mean by chelate and macrocyclic effect. Explain with examples. 2+3+2+  
3=10
- b. Name the different types of structural isomerism observed in coordination compounds with examples.
- c. Write the factors affecting the stability of a complex by the chelate effect of the ligand.
- d. What are the types of attacking reagents for a substitution reaction in square planar complexes?
8. a. Discuss the synthesis of ferrocene? 2+2+3+  
3=10
- b. What is a chelating ligand? What is the medical use of chelating ligands? Give one example.
- c. Explain the splitting of *d*-orbitals in an octahedral crystal field with proper diagram.
- d. Explain the effect of size and charge of a ligand on the stability of a complex.

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