**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 86**
**(For candidates admitted from the academic year 2006–07 & thereafter)**

**SUBJECT CODE : CH/PC/CO44**

**M.Sc. DEGREE EXAMINATION APRIL 2009**
**BRANCH IV – CHEMISTRY**
**FOURTH SEMESTER**

**REG.NO .....**

**COURSE : CORE**
**PAPER : COORDINATION CHEMISTRY**
**TIME : 30 MINS** **MAX. MARKS :20**

**SECTION – A**
**TO BE ANSWERED ON THE QUESTION PAPER ITSELF.**

**Answer all the questions.** **(20 x 1= 20)**

**I CHOOSE THE CORRECT ANSWER:**

1. In a six-coordinate complex of the formula $MA_3B_3$ the facial isomer will have
   a) Three identical ligands in a plane bisecting the molecule.
   b) Three identical ligands on one triangular face.
   c) Three identical ligands on one edge of the octahedron while the other identical ligands around the opposite edge of the octahedron.
   d) Two identical ligands occupying opposite position of the octahedron.

2. Electronic transitions between MOs mainly localized on the central metal are called as
   a) Ligand field transitions b) Electron transfer transitions
   c) Internal ligand transitions d) Intra-ligand transition

3. Valence bond theory is based on
   a) Hybridization
   b) Electrostatic field
   c) Interaction of metal and ligand orbital
   d) Relative orientation of the frontier orbitals

4. The purple colour of $[Ti(H_2O)_6]^{3+}$ is due to the following transition
   a) $t_{2g}^{\ 0}e_g^{\ 1} \rightarrow t_{2g}^{\ 1}e_g^{\ 0}$ b) $t_{2g}^{\ 3}e_g^{\ 0} \rightarrow t_{2g}^{\ 2}e_g^{\ 1}$
   c) $t_{2g}^{\ 1}e_g^{\ 0} \rightarrow t_{2g}^{\ 0}e_g^{\ 1}$ d) $t_{2g}^{\ 3}e_g^{\ 1} \rightarrow t_{2g}^{\ 2}e_g^{\ 2}$

5. The CFSE for an octahedral high spin $d^4$ metal ion is
   a) 0.4 $\Delta_0$ b) 1.2 $\Delta_0$ c) 0.6 $\Delta_0$ d) 0.8 $\Delta_0$

6. The free-ion ground term for $Cu^{2+}$ is
   a) $^3F$ b) $^2D$ c) $^6S$ d) $^4F$

7. The g value for a free electron is
   a) 2.0023 b) 2.1023 c) 2.2023 d) 2.3023

8. The macrocyclic ligand tetraazacycloetradecane is commonly known as
   a) Corrin b) Cupron c) Crypt d) Cyclam

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9. An example for a conjugated macrocyclic ligand is
   a) Tet-A b) Crown ether c) Porphyrin d) Cryptand

10. The most abundant metallic element in the human body is
    a) Copper b) Zinc c) Iron d) Cobalt

## II FILL IN THE BLANKS:

11. Thermodynamic stability of the complexes depends on _____.
12. The energy difference between $t_{2g}$ and $e_g$ sets for tetrahedral complexes is represented as _____.
13. Mossbauer spectroscopy involves nuclear transitions resulting from the absorption of _____ by the sample.
14. Polyethers in which the ther oxygen atoms separated by two methylene groups are called as _____.
15. The central metal present in chlorophyll is _____

## III ANSWER IN ONE OR TWO SENTENCES:

16. The stability of $[Ni(en)_3]^{2+}$ is much greater than that of $[Ni(NH_3)_6]^{2+}$, although both contains $Ni-N$ bonds. Give reason.

17. High spin octahedral $Mn^{2+}$ complexes obey spin only formula very closed. Why?

18. What is nephelauxetic effect?

19. Name any one natural product that contains a macrocyclic ligand system.

20. Mention the role of calcium in biology.

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**TIME : 2 HOURS & 30 MINS** **MAX. MARKS :80**

## SECTION – B

**Answer any five questions.** **(5x8=40)**

1. Describe the determination of stability constant of a complex by spectophotometric method.

2. State and explain Jahn-Teller theorem.

3. a) Mention the common reference material used in recording EPR spectrum
   b) Explain the EPR spectrum of bis(salicylaldimine) copper(II) complex. (2+6)

4. Wit two examples, explain how template method could be used to synthesize macrocyclic complexes.

5. Wrote short notes on vitamin B-12 coenzymes and their roles.

6. Explain photosubstitution reaction with an example.

7. What is trans-effect? Explain the poalization theory of trans-effect.

## SECTION – C

**Answer any two questions.** **(2x20=40)**

8. a) With the help of Tanabe-Sugano diagram, explain the expected electronic spectrum for an octahedral Ni(II) complex. (10)
   b) Construct and explain the molecular orbital diagram of an octahedral sigma complex. (10)

9. a) Discuss the various factors affecting the stability of complexes. (10)
   b) The isomer shift of $Sn^{2+}$ compounds is positive compared to $Sn$ with respect to EPR. Explain (5)
   c) How is imine forming reactions used to develop macrocyclic ligands? (5)

10. a) Give an account of the functioning of hemoglobin and myoglobin in the oxygen transport, highlighting the Perutz mechanism. (10)
    b) Explain photoisomerization reaction with a suitable example. (6)
    c) Write short notes on spectrochemical series. (4)

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