

Register Number:

Date:



ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27

B.Sc.-VI SEMESTER

SEMESTER EXAMINATION: APRIL 2023

(Examination conducted in May 2023)

CH 6118 – INORGANIC CHEMISTRY

(For current batch students only)

Time: 2½ Hours

Max Marks: 70

This paper contains 2 printed pages and 3 parts.

Element	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
At. no.	21	22	23	24	25	26	27	28	29	30

PART A

Answer any **six** questions.

(6 x 2= 12)

1. Why do d-block elements have a high tendency to form coordination complexes?
2. Calculate the crystal field stabilization energy (CFSE) for a d^3 metal ion in an octahedral ligand field.
3. Mention any two limitations of crystal field theory.
4. Give an example of an interhalogen compound and indicate the oxidation states of the halogens in it.
5. Write the formula of the first noble gas compound prepared by Bartlett experiment. How was it prepared?
6. What is the composition of Ziegler-Natta catalyst?
7. Give any two biological functions of calcium.
8. Write the general valence electronic configuration of lanthanides. Mention their common oxidation state.

PART B

Answer any **eight** questions.

(8 x 6= 48)

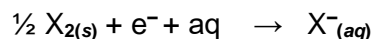
9. a) Calculate the effective atomic number (EAN) of the following complexes. (3+3)
i) $[\text{Ni}(\text{CN})_4]^{2-}$ ii) $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3$
b) Give an example (with structures) of each of the following.
i) a bidentate ligand ii) a chelate complex iii) an ambidentate ligand
10. Illustrate the postulates of Werner's theory taking $\text{CoCl}_3 \cdot 6\text{NH}_3$ as an example.

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11. In each pair given below, identify the complex having larger crystal field splitting energy. Justify your choice.
- i) $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Rh}(\text{NH}_3)_6]^{3+}$ ii) $[\text{NiCl}_4]^{2-}$ (tetrahedral) and $[\text{NiCl}_6]^{4-}$
 iii) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
12. $[\text{FeF}_6]^{3-}$ is a high spin complex while $[\text{Fe}(\text{CN})_6]^{3-}$ is a low spin complex. Explain this observation based on crystal field theory.
13. With the help of an orbital overlap picture, explain the bonding in metal carbonyls. What is meant by synergetic effect?
14. Explain the cooperativity mechanism in the binding of haemoglobin with oxygen.
15. Compare lanthanides and transition elements with respect to their i) electronic spectra ii) oxidation state and iii) magnetic properties.
16. a) Explain the structure of XeO_3 based on hybridization concept. (at. no. of Xe = 54) (3+3)
 b) Define hapticity of a ligand. Give an example each of monohapto and dihapto ligands.
17. a) Between La^{3+} and Lu^{3+} which one gets eluted first from the ion-exchange column during the separation of lanthanides by cation exchange chromatography? Explain. (3+3)
 b) Arrange the following oxyacids of halogens in the increasing order of their acid strength. Justify the order.



18. Construct a Born-Haber cycle for the following conversion and write the expression for energy change of the reaction, ΔE , which is a measure of the oxidation potential of halogen.



PART C

Answer any **two** questions.

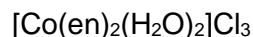
(2 x 5= 10)

19. a) Among the complex ions given below, pick the one which possesses the highest magnetic moment. Justify your choice. (3+2)



b) Does high spin Cr^{2+} show Jahn-Teller distortion? Give reason.

20. Write the structures of any four isomers of the following complex.



21. Deduce the structure of ClF_2^- ion based on VSEPR theory. (at. no. of Cl = 17)
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