2026

6th Semester Examination (CCFUP : NEP)

CHEMISTRY

Paper : MJ 11-T

(Single Core Major)

(Inorganic Chemistry-IV)

Full Marks : 40 Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group - A

Answer any ***five*** questions : 2×5=10

1. What are metalloproteins and metalloenzymes?
2. Name two clinically approved drugs of platinum (II) for the treatment of cancer.
3. Why does Wilkinson's catalyst act in a selective manner?
4. How will you chemically differentiate between *cis* and *trans* isomers of $[Pt(NH_3)_2Cl_2]$.
5. Determine ground state term symbols for Sm^{3+} and Eu^{3+}.

P.T.O.

6. What is the major function of Ziegler-Natta catalyst? Write the active species in Ziegler-Natta catalyst.

7. What is hapticity? Give an example of mono-hapto cyclopentadienyl complex.

8. What is chelation therapy? How As-toxicity can be treated using chelation therapy?

Group - B

Answer any ***four*** questions : 5×4=20

9. (a) Draw the active site structure of Myoglobin and Hemerythrin and comment on the oxygen binding modes for each.

   (b) Compare the Coordination sphere of cytochrome *a* with that of cytochrome *c*. 3+2

10. (a) Explain the trends of C – O stretching frequencies of the given metal carbonyls :

	$V(CO)_6^-$	$[Cr(CO)_6]$	$Mn(CO)_6^+$
$\nu_{CO}(cm^{-1})$:	1860,	2000,	2090

   (b) What will be the change in C – C bond distance when hydrogen atoms in ethylene are substituted by fluorine atoms in Zeise's salt? — Justify your answer. 3+2

11. (a) What is Wilkinson's catalyst? Mention the example of oxidative addition and reductive elimination with reference to the hydrogenation of alkene with Wilkinson's catalyst.

   (b) Explain, why ferrocene is unreactive toward iodine while cobaltocene rapidly decolorizes the colour of the iodine solution. 3+2

12. (a) Arrange the ligands H_2O, NH_3, NO_2^-, and Cl^- in order of increasing *trans* effect and hence design two-step synthesis of the *cis*- and *trans*-isomers of $[Pt(NH_3)_2(NO_2)_2]$ starting from $K_2[PtCl_4]$.

   (b) Explain why lanthanide coordination compounds exhibit sharp electronic absorption bands in their spectra. 2+3

13. (a) What is lanthanide contraction? The third ionization energy for Eu and Yb are comparatively higher than other lanthanides. — Explain.

   (b) On the basis of 18e rule, find 'z' and 'M' in the following :

   (i) $\left[Ni(NO)_3(SiMe_3)\right]^z$

   (ii) $\left[\left(\eta^3-C_3H_3\right)\left(\eta^5-C_5H_5\right)M(CH_3)(NO)\right]$

   (NO has linear coordination in both complexes) 3+2

14. (a) State the function of Nitrogenase enzyme and describe the active site structure of the enzyme.

(b) A 'stable complex' does not mean it is always inert — Explain the statement with proper example. 3+2

Group - C

Answer any ***one*** question : 10×1=10

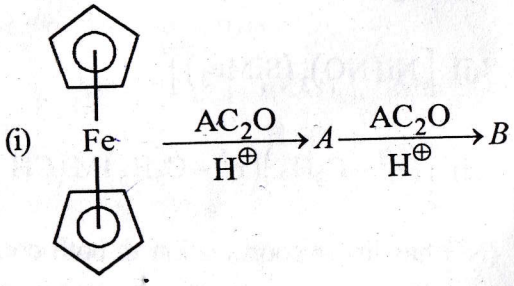
15. (a) Calculate the number of M – M bond and predict the structures of the following complexes :

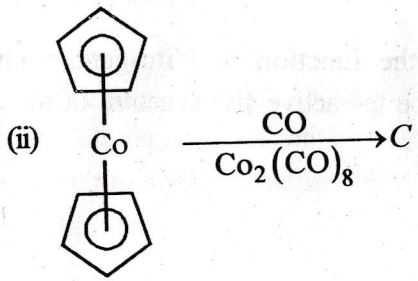
(i) $[W_2(OPh)_6]$

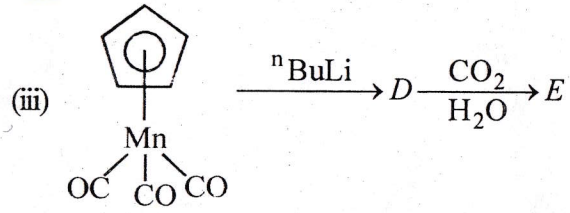
(ii) $Co_4(CO)_{16}$

(b) Briefly describe the function of Carbonic Anhydrase.

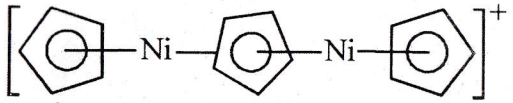
(c) Complete the following reactions :

(i) 

(ii) 

(iii) 

(d) How do you synthesize the following species from nickelocene?



2+2+3+3

16. (a) What are PS I and PS II? Explain their roles in the process of photosynthesis.

(b) Explain the terms 'Cooperative effect' and 'Bohr effect' in connection with oxygen transport in human body.

(c) Comment on the statement : 'Nb' and 'Ta' are difficult to separate from the mixture of their ores.

(d) Using *trans* effect phenomenon prepare all possible stereoisomers of $PtCl(NH_3)(Py)Br$ starting from $PtCl_4^{2-}$.

(e) Give an example of reaction that follows inner sphere mechanism. 2+2+2+2+2