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B.Sc/6th Sem (H)/CHEM/23(CBCS)

2023

6th Semester Examination

CHEMISTRY (Honours)

Paper : C 13-T

[Inorganic Chemistry-V]

[CBCS]

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 : $2 \times 5 = 10$

1. Using 18-electron rule, find the value of 'n' in $(\eta^5 - C_p)Co(CO)_n$.
2. What is the formal oxidation state of iron in $Na_2[Fe(CN)_5NO]$?
3. Show that substitution in square planar complexes is an associative process.
4. Acetylation of ferrocene produces only one major product. Explain why.

P.T.O.

5. Between $Rh(PEt_3)Cl$ and $Rh(PPh_3)_3Cl$ which one is suitable for Wilkinson's type catalyst for hydrogenation of olefins? Explain.
6. What is synergic effect and how does it relate to metal-carbonyl bonding?
7. In the series $Ni(II)$, $Pd(II)$ and $Pt(II)$, only $Pt(II)$ shows significant trans effect. Justify.
8. What is Fischer-Tropsch process?

Group - B

Answer any *four* questions : $5 \times 4 = 20$

9. What is *trans* effect? How would you proceed to prepare *cis*- and *trans*- $[Pt(NH_3)(NO_2)Cl_2]^-$ from $[PtCl_4]^{2-}$ in two steps using NH_3 and NO_2^- ? $1+2+2$
10. (a) Discuss the structure and bonding of the Zeise's salt.
- (b) On the basis of 18e rule, find 'z' and 'M' in the following :
 - (i) $[Ni(NO)_3(SiMe_3)]^z$
 - (ii) $[(\eta^3-C_3H_3)(\eta^5-C_5H_5)M(CH_3)(NO)]$

NO has linear coordination in both cases. $3+2$
11. (a) Show the catalytic cycle for the polymerisation of propene using an organometallic catalyst.

(b) Why does Pb^{2+} appear both in Gr. I and Gr. IIA during qualitative analysis of inorganic salts? 3+2

12. (a) Draw *Bailar* twist and *Ray-Dutt* twist for the interconversion of enantiomers Δ and Λ of $M(L-L)_3$.

(b) What is Bohr effect? Explain. 2+2+1

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

(b) In the IR spectrum of free $MeCH=CH_2$, $\nu_{C=C}$ comes at 1652 cm^{-1} , but in the complex $K\left[PtCl_3\left(\eta^2-MeCH=CH_2\right)\right]$, the corresponding absorption is at 1504 cm^{-1} . Comment on the observation. 3+2

14. (a) Discuss, with examples, the differences between inner- and outer-sphere mechanisms, and state what is meant by a self-exchange reaction.

(b) Write the advantages of using Rh-catalyst in place of Co-catalyst in hydroformylation reaction. 3+2

Group - C

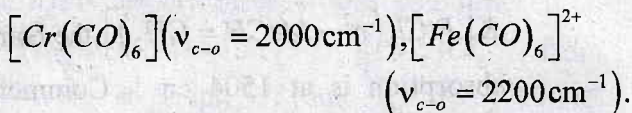
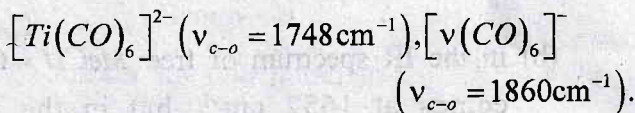
Answer any **one** question : 10×1=10

15. (a) Explain the metal ion transport across bio-membranes with reference to the function of Na^+ / K^+ pump.

P.T.O.

- (b) Show by examples oxidative addition and insertion reactions in organometallic complexes.
- (c) Write and explain the light and dark phase reactions related to photosynthesis.
- (d) Draw the structure of 4Fe-4S ferredoxin and mention its biological function. 3+2+4+1

16. (a) The ν_{C-O} of isoelectronic hexacarbonyls is given below. Explain their trends. ($\nu_{C-O} = 2143 \text{ cm}^{-1}$ in free CO).



- (b) Draw the microenvironment of the active site of Hemocyanin.
- (c) Illustrate by an example using its qualitative molecular orbital diagram the reason for the stability of $18e^-$ organometallic complexes.
- (d) How is ferrocene converted to $(\eta^5 - C_5H_5)Fe(\eta^5 - C_5H_4NH_2)$?
- (e) Applying 18-electron rule deduce the structure of $Fe_3(CO)_{12}$. Show the different modes of bonding of CO in this structure. 3+2+2+1+2
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