

B.Sc. 6th Semester (Honours) Examination, 2024 (CBCS)**Subject : Chemistry****Course : CC-XIII****Time: 2 Hours****Full Marks: 40***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.***1. Answer any five questions:**

2×5=10

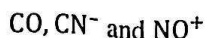
- (a) Differentiate between oxidative addition and reductive elimination reactions with examples.
- (b) What do you mean by chelation therapy?
- (c) Show the structure of $\text{Co}_2(\text{CO})_8$ molecule in solid state.
- (d) $\text{Ni}(\text{CO})_4$ is stable but $[\text{Zn}(\text{CO})_4]^{2+}$ does not exist, why?
- (e) What do you mean by thermodynamically stable and kinetically labile complexes?
- (f) The five coordinate intermediate in square planar substitution might also have a square pyramid geometry with higher LFSE. What factors favour the trigonal bipyramid geometry?
- (g) Identify the products 'A' and 'B' in the following reactions:
- $$2 \text{Fe}(\text{CO})_5 \xrightarrow{h\nu} \text{'A'}$$
- $$\text{Ni}(\text{CO})_4 \xrightarrow[30^\circ \text{C}]{\text{PF}_3} \text{'B'}$$
- (h) Write the IUPAC name of Wilkinson's catalyst. Mention the hybridisation of its central metal ion.

2. Answer any two questions:

5×2=10

- (a) (i) What do you mean by the term hapticity of organic ligands? Give suitable example(s).
- (ii) Find the value of 'x' and 'y' assuming validity of 18e rule: $\text{Fe}(\eta^5 - \text{C}_p)(\text{CO})_x(\text{NO})_y$.
(2+1)+2
- (b) (i) What happens when finely divided iron metal reacts with carbon monoxide directly at high temperature and pressure?
- (ii) Comment on the following observed values of $\nu_{\text{C-O}}$ (cm^{-1})
2+3
- | | | |
|--------------------------|------------------------------|------|
| $\text{Cr}(\text{CO})_6$ | $[\text{Mn}(\text{CO})_6]^+$ | CO |
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- (c) (i) Compare the relative rates of hydrogenation using Wilkinson's catalyst of the following compounds:
Cyclohexene and 1-methyl cyclohexene — justify your answer.
- (ii) Write one synthetic route to obtain Zeise's salt. (1+2)+2
- (d) (i) Compare the σ -donor ability and π -acceptor effectiveness (with justification) of the following:



- (ii) Write the difference(s) between Photosystem I and Photosystem II. 3+2

3. Answer any two questions:

10×2=20

- (a) (i) Write briefly the functions of hemocyanine and hemerythrin.
- (ii) What is hydroformylation reaction? How can you obtain $\text{R}_2\text{CH}-\text{CH}_2-\text{C} \begin{array}{l} \text{O} \\ \text{=O} \\ \text{H} \end{array}$ from $\text{R}_2\text{C}=\text{CH}_2$? Show the different steps involved in this process. (2+2)+(1+2+3)
- (b) (i) Give one suitable example of each of 1,1-insertion and 1,2-insertion reactions in organometallic complexes.
- (ii) What do you mean by crystal field activation energy (CFAE)? Mention its importance.
- (iii) Mention the factors favouring the associative path in inorganic reaction mechanism. (2+2)+(1½+1½)+3
- (c) (i) Compare the strengths of *cis*-effect and *trans*-effect with suitable examples. Mention one application of *trans*-effect.
- (ii) What do you mean by the term Reaction Profile? Show the Reaction Profile for dissociative or 'D' mechanism of substitution reaction.
- (iii) Briefly explain the term co-operativity in hemoglobin. (3+1)+(1+2)+3
- (d) (i) What do you mean by essential elements? Mention one biological role of potassium.
- (ii) What is Bohr effect?
- (iii) In between hemoglobin and myoglobin which has more affinity for oxygen? Comment.
- (iv) Mention the toxic effects of cadmium.
- (v) Give an example of naturally occurring M-C σ -bonded species.
- (vi) Draw the structure of a metalloporphyrin framework and count the number of π -electrons. (1+1)+1+2+2+1+2