

**M.Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2024****SEMESTER 1 : CHEMISTRY / PHARMACEUTICAL CHEMISTRY****COURSE : 21P1CHET01 / 21P1CPHT01 : INORGANIC CHEMISTRY - I***(For Supplementary/Improvement -2023/2022/ 2021 Admission)*

Duration : Three Hours

Max. Weights: 30

**PART A****Answer any 8 questions****Weight: 1**

1. The complex  $[(\text{CO})_3(\text{PPh}_3)_2\text{Mn}-^{13}\text{CO}-\text{CH}_3]$  loses carbon monoxide on decarbonylation. Would you expect this carbon monoxide to be  $^{12}\text{CO}$ ,  $^{13}\text{CO}$  or a mixture of both? Why? (An)
2. What is amine oxidase? Explain its function. (A, CO 3)
3. For hydrogenation of ethylene. Both  $\Delta G^0$  and  $\Delta H^0$  are negative, but still uncatalyzed reaction will not occur. Why? (A)
4. What is transferrin? Give its mode of action (A, CO 3)
5. Discuss on the simultaneous determination of  $\text{Zn}^{2+}$  and  $\text{Cu}^{2+}$  by radiometric titration (A, CO 4)
6. What is Wulff–Dötz reaction? (R, CO 2)
7. Explain the technique Prompt Gamma Neutron activation analysis based on radioactivity. (U, CO 4)
8.  $\text{N}_2$  has molecular orbitals rather similar to those of CO. Would you expect  $\text{N}_2$  to be a stronger or weaker  $\pi$ - acceptor than CO? Give reason (An)
9. Consider the carbonylation of *Cis* –  $[(\text{CH}_3)\text{Mn}(^{13}\text{CO})(\text{CO})_4]$  with unlabeled CO. Assuming that methyl migration occurs, predict the products and their ratio. (A)
10. On the basis of the 18 electron rule identify the first row transition metal for each of the following (An)
  - a)  $[(\eta^3\text{-C}_3\text{H}_3)(\eta^5\text{-C}_5\text{H}_5)\text{M}(\text{CO})]^-$
  - b)  $[(\eta^3\text{-C}_3\text{H}_3)(\eta^5\text{-C}_5\text{H}_5)\text{M}(\text{NO})(\text{CH}_3)]$

**(1 x 8 = 8)****PART B****Answer any 6 questions****Weights: 2**

11. Explain the structure and mechanism of nitrogen fixation by nitrogenase enzyme. (A, CO 3)
12. Explain the regioselectivity in alkane carbonylation under short wavelength radiations. (An, CO 2)
13. Explain the mechanism involved in radiolysis of water. (U, CO 4)
14. Square planar complexes of ligands having both sigma donor and pi acceptor characteristics, a 16-electron configuration is more stable than 18-electron configuration. Explain (An)
15. Briefly explain the structure and important functions of Vitamin B<sub>12</sub> (A, CO 3)
16. What is platinum POP? Explain the mechanism of photo dehydrogenation using POP catalyst. (U)
17. Calculate the TEC, PEC and predict the structures of (An)
  - a)  $\text{Ru}_5(\text{CO})_{16}\text{C}$
  - b)  $[\text{Os}_5(\text{CO})_{15}]^{2-}$

18. Write a note on rearrangement reactions in organometallic compounds. Suggest suitable examples. (U, CO 1)

(2 x 6 = 12)

**PART C**

**Answer any 2 questions**

**Weights: 5**

19. Discuss in detail about Photosystem I and Photosystem II with the aid of Z-scheme (A, CO 3)
20. Distinguish between Fischer and Schrock carbenes. How are they prepared? Explain the bonding scheme present in these carbenes. (An, CO 1)
21. a) Write a note on fluxional isomerism exhibited by organometallic compounds. How NMR spectroscopy is useful to study the fluxionality in various organometallic compounds. b) Explain the basic principles of G.M. and proportional counters used in radioactive counting. (U, CO 2, CO 4)
22. Explain the mechanism of Wacker process using catalytic cycle. Mention its rate expression and give evidences for the mechanism. (U)

(5 x 2 = 10)

**OBE: Questions to Course Outcome Mapping**

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	Describe the key concepts of inorganic and organometallic chemistry including those related to synthesis, reaction chemistry, and structure and bonding	A	18, 20	7
CO 2	Explain stability of organometallic compounds and clusters, and their application as industrial catalysts.	U	6, 12, 21	8
CO 3	Categorize the interaction of different metal ions with biological ligands	An	2, 4, 11, 15, 19	11
CO 4	Demonstrate a systematic understanding of the key aspects of nuclear chemistry and their analytical applications	A	5, 7, 13, 21	9

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;