


Name:			
Enrolment No:			
UPES End Semester Examination, December 2023			
Course: Organometallic and Bioinorganic Molecules Program: MSc. Chemistry Course Code: CHEM7048		Semester: 1 Time: 03 hrs. Max. Marks: 100	
Instructions:			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Define hapticity of a ligand. What is the hapticity of benzene ring and cyclooctatetraene?	4	CO1
Q2	Identify x and Z for the metal complex $[V(CO)_x]^{Z-}$ so that it obeys the 18-electron rule.	4	CO3
Q3	Explain the structures of a. Ferrocene in eclipsed and staggered form. b. Zeise's salt	2+2	CO2
Q4	What are metalloenzymes? Give two examples of Zinc containing metalloenzymes and their biological functions.	4	CO1
Q5	Draw the Tollman's catalytic loop for hydrogenation of alkenes by Wilkinson's catalyst.	4	
SECTION B (4Qx10M= 40 Marks)			
Q6	Explain how is the oxygen carrying capacity of hemoglobin determined by? a. Cooperativity effect and b. Bohr's effect.	5+5	CO4
Q7	Identify the possible hapticity of the following ligands with a single d-block metal atom. a. Butadiene b. Cyclopentadienyl c. $C_3H_5^-$ d. Ethene	2.5+2.5+2.5 +2.5	CO2
Q8	Discuss the oxidation state of Iron in oxy-hemoglobin and deoxy-hemoglobin.	10	CO2
Q9	Draw the oxygen saturation curves for myoglobin and hemoglobin and justify why myoglobin has greater affinity for oxygen than hemoglobin.	10	CO1

	OR		
	What role does Cytochrome P-450 play in biological systems? Explain.		
SECTION-C (2Qx20M=40 Marks)			
Q 10	<p>a. Explain which of the following metal complexes will obey 18 electron rules?</p> <p style="padding-left: 40px;">A) $[(\eta^5 - C_5H_5)Fe(CO)_2]_2$</p> <p style="padding-left: 40px;">B) $[(\eta^5 - C_5H_5)Mo(CO)_2]_2^{2-}$</p> <p style="padding-left: 40px;">C) $[Ir(CO)_2Br_2]^{2+}$</p> <p style="padding-left: 40px;">D) $Os(CO)(\equiv CPh)(PPh_3)_2 Cl$</p> <p>b. Draw the molecular orbital diagram of carbonyl (CO). Why CO a carbonyl is considered a good σ-donor as well as a good π-acceptor ligand.</p>	10+10	CO4
Q11	<p>a. Differentiate between the dissociate substitution and associate substitution reactions of metal carbonyls. Write suitable examples.</p> <p>b. A green Chromium Compound A on fusion with alkali gives a yellow compound B which on acidification gives an orange-colored Compound C which on treatment with NH_4Cl, gives another orange-colored product D. The product D on strong heating decomposes to gives back compound A. Identify A, B, C and D write down the equations involved in these chemical reactions.</p>	10+10	CO3
OR			
	Draw the structure of chlorophyll. What role does it play during photosynthesis? Discuss in detail.	20	CO4