

U. G. 6th Semester Examination 2022

CHEMISTRY (Honours)

Paper Code : CEMH DC-13

[Inorganic Chemistry]

Full Marks : 25

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.

1. Answer any *five* questions from the following: 1×5=5

(a) In the catalytic hydration of CO₂ by carbonic anhydrase, CO₂ first interacts with

- (i) H₂O of the active site of the enzyme and then with zinc.
- (ii) OH group of the active site of the enzyme and then with zinc.
- (iii) Zinc of the active site of the enzyme and then with H₂O.
- (iv) Zinc of the active site of the enzyme and then with OH group.

(b) Deoxy-hemocyanin is

- (i) O₂ transporter and paramagnetic.
- (ii) Heme protein and paramagnetic.
- (iii) Blue coloured and diamagnetic.
- (iv) Colourless and diamagnetic.

(c) 2 Fe-ferredoxin, in its reduced form two iron centers contain

- (i) 9 electrons.
- (ii) 10 electrons.
- (iii) 11 electrons.
- (iv) 12 electrons.

(d) Kinetically inert complex is

- (i) [Cr(H₂O)₆]²⁺
- (ii) [Cr(H₂O)₆]³⁺
- (iii) [Fe(H₂O)₆]²⁺
- (iv) [Fe(H₂O)₆]³⁺

[P.T.O.]

- (e) If nitrosyl is coordinated in bent fashion in $[(\eta^3 - \text{C}_3\text{H}_5)\text{Ir}(\text{PPh}_3)(\text{NO})]^+$, then the electron count for the complex ion should be
- (i) 14
 - (ii) 16
 - (iii) 18
 - (iv) 20
- (f) $[\text{Mn}(\text{CO})_4(\text{NO})]$ and $[\text{Fe}(\text{CO})_4(\text{CN})]^-$ have trigonal-bipyramidal structure, where
- (i) NO and CN^- both occupy the axial position.
 - (ii) NO and CN^- both occupy the equatorial position.
 - (iii) NO is in the axial but CN^- is in the equatorial position.
 - (iv) NO is in the equatorial but CN^- is in the axial position.
- (g) Considering the 18-electron rule, the number of Os-Os bonds present in $\text{Os}_4(\text{CO})_{14}$ is
- (i) 4
 - (ii) 5
 - (iii) 6
 - (iv) 8
- (h) $[\text{IrCl}(\text{PPh}_3)_3]$ is not a substitute for Wilkinson's catalyst because
- (i) Ir-P bond is much stronger than Rh-P bond.
 - (ii) Ir-P bond is much weaker than Rh-P bond.
 - (iii) Ir-Cl bond is much stronger than Rh-Cl bond.
 - (iv) Ir-Cl bond is much weaker than Rh-Cl bond.
2. Answer any **four** questions from the following: 2×4=8
- (a) Mention the role of manganese cluster in photosynthesis.
 - (b) How As-toxicity can be removed by chelation therapy?
 - (c) Explain the function of carbonate-bicarbonate buffering system in human body.
 - (d) What do you mean by insertion reaction? Cite one suitable example.
 - (e) What is Ziegler-Natta catalyst? What product do you expect if propylene is subjected to Ziegler-Natta catalyst?
 - (f) Explain why dimeric manganese carbonyl is susceptible to nucleophilic attack.
 - (g) Ferrocene undergoes electrophilic substitution reaction at a faster rate compared to benzene-Explain.

(h) How can you prepare cis- and trans- isomers of $[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_2(\text{NH}_3)]$ from K_2PtCl_4 by using trans effect phenomenon?

2. Answer any *two* questions from the following: 6×2=12

- (a) (i) Explain the term 'Cooperative effect' in connection with oxygen transport in human body. 3+3
- (ii) The carbonyl stretching frequency of $\text{Mo}(\text{CO})_6$, $\text{Mo}(\text{CO})_3(\text{NH}_3)_3$ and $\text{Mo}(\text{CO})_3(\text{PPh}_3)_3$ are 2004, 1855 and 1950 cm^{-1} respectively. Give reasons for the observation. 3
- (b) (i) Do you expect any rotation of the ethylene molecule in Zeise's salt, without hampering the stability of the complex? Explain your answer. 'The colour of bromine solution is discharged by passing ethylene but not using Zeise's salt'—Explain. 2+1
- (ii) Explain the mechanism of Na^+/K^+ ion pump across the biomembranes. 3
- (c) (i) What is hydroformylation reaction? Describe the role of a suitable organometallic compound mentioning the 'active catalyst' in the above process. 3
- (ii) What are PSI and PSII? Explain their roles in the process of photosynthesis. 3
- (d) (i) 'Depending on reaction conditions octahedral substitution reactions may acquire an associative path'— Explain. 3
- (ii) How would you chemically show that the two cyclopentadienyl rings in ferrocene freely rotate around the metal ligand axis? How would you oxidize ferrocene to ferricinium ion? 2+1
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