বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2022

(Under CBCS Pattern)

Semester - VI

Subject: CHEMISTRY

Paper : C 13 - T

(Inorganic Chemistry)

Full Marks : 40

Time : 2 Hours

Candiates are required to give their answer in their own words as far as practicable.
The figures in the margin indicate full marks.

Group - A

Answer any ***four*** from the following questions : 5×4=20

1. (a) What are the functions of 'Heme' and 'Globin' in Hemoglobin? 2

   (b) How do you prepare ferrocene? Explain the stability of the complex. 3

2. (a) Write short note on Ziegler-Natta catalysis. 2

   (b) Write down the sequence of reactions in 'PS-I' and 'PS-II'. 3

3. (a) Draw the synergic bonding in metal carbonyls. 2

   (b) Which metal ion is present in carbonic anhydrase enzyme? Enumerate the anhydrase activity of this enzyme. 3

4. (a) Comment on the following CO stretching frequencies : 3

$$\underset{2037\,cm^{-1}}{[Ni(CO)_4]} > \underset{1918\,cm^{-1}}{[Co(CO)_4]^-} > \underset{1788\,cm^{-1}}{[Fe(CO)_4]^{2-}}$$

(b) Explain the principle of chelation therapy with reference to the removal of arsenic. 2

5. (a) How does nature protect Fe(II) in Hemoglobin from its irreversible oxidation in presence of O_2 ? What do you mean by cooperative interaction in O_2 affinity of Hemoglobin? (2+1)

(b) Low oxidation state organometallic complex tend to obey the 18-electron rule. Justify with example. 2

6. (a) What is nitrogenase ? What is its biological function ? 2

(b) What is an insertion reaction ? Give two examples for this. 3

Group - B

Answer any ***two*** from the following questions : 10×2=20

1. (a) Comment on the CO stretching frequencies $\left(\nu_{co} cm^{-1}\right)$ in the following compounds.

$$\underset{1860}{V(CO)_6^-} \quad \underset{2000}{Cr(CO)_6} \quad \underset{2090}{Mn(CO)_6^+}$$

(b) Sketch a catalytic cycle for the hydroformylation of $RCH{=}CH_2$ using an organometallic catalyst indicating steps where insertion and oxidative addition reactions occur.

(c) Starting from $(NH_4)_2[PtCl_4]$ how will you synthesize cis-and trans-platin. 2+4+4=10

2. (a) Show that Rh in $\left[(CO)_2 Rh(\mu - Cl)_2 Rh(CO)_2\right]$ does not obeys 18-electron rule.

(b) Based on EAN rule draw the structures of $Mn_2(CO)_{10}$, $Co_2(CO)_8$ and $Fe_2(CO)_9$. Count the number of bridging 'CO' groups.

(c) Write down the roles of Na^+, K^+, Ca^{2+}, Mg^{2+}, Cu^{2+}, Zn^{2+} in life.

(d) Which one is more toxic –Hg^{2+}, CH_3HgCl, $(CH_3)_2Hg$ and why ? 2+3+3+2=10

3. (a) What is Wilkinson's catalyst ? Give the catalytic cycle for the hydrogenation of ethylene molecule using Wilkinson's catalyst.

(b) Comment on the CO stretching frequencies $\left(\nu_{co} cm^{-1}\right)$ in the following compounds:

CO	$\left[Ti(CO)_6\right]^{2-}$	$\left[V(CO)_6\right]^{-}$	$\left[Cr(CO)_6\right]$	$\left[Mn(CO)_6\right]^{+}$
2143	1750	1860	2002	2090

(c) Using 18-electron rule as guide, find the number 'n' of CO in the following compounds : $\left[Mn_2(CO)_n\right], \left[Co\left(\eta^5 - C_5H_5\right)(CO)_n\right]$ (1+3)+3+3=10

4. (a) How would you design a synthesis of the complex trans-$\left[PtCl_2(NH_3)(tu)\right]\{tu = (H_2N)_2 CS\}$.

(b) Do you expect any rotation of the ethylene molecule in the Zeise's salt without hampering the stability of the complex ? Explain.

(c) Compare the oxygen affinity of Hemoglobin and Myoglobin.

(d) The V-C bond lengths in $V(CO)_6$ and $V(CO)_6^-$ are 200 pm and 193 pm respectively. Explain. 2+3+2+3=10