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(July)

CHEMISTRY

(Honours)

(Part-A : Inorganic Chemistry)

(Chem-H-601)

Marks : 38

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

Answer any **one** question from each Section

SECTION—I

1. (a) What is meant by the π -acidity of a ligand? Compare the bonding characteristics of metal carbonyls and metal nitrosyls. 4
- (b) Give the mechanism of homogeneous hydrogenation of alkenes with Wilkinson's catalyst. 3
- (c) Give the structure of Zeise salt. 1
- (d) Give one method of preparation and one use of alkyl-lithium compounds. 2

2. (a) Write one method of preparation of $(C_2H_5)_2SnX_2$ and draw its structure. Give two applications of organotin compounds. 3+2=5
- (b) Write down the steps involved in the synthesis of acetic acid using rhodium carbonyl iodide catalyst. 2½
- (c) Explain the bonding involved in metal-ethylene complexes. 2½

SECTION—II

3. (a) What are the criteria for an element to be considered as essential element? 2
- (b) List the diseases associated with deficiency and excess of Fe, Ca and I. 3
- (c) Discuss the structure of chlorophyll and explain the light and dark reactions in photosynthesis. 5
4. (a) In vitamin- B_{12} , what is the oxidation state of Co? Which ligands occupy the 5th and 6th coordination positions of Co in vitamin- B_{12} ? Discuss the methylation reaction involving vitamin- B_{12} . 5

(3)

(b) Give a probable mechanism for the reversible hydration of CO_2 by carbonic anhydrase. 3

(c) What are the toxic effects associated with the following metal ions? 2
Hg, Pb, Be and Al

SECTION—III

5. (a) Discuss the Orgel combined energy level diagram for d^1 and d^9 systems for octahedral and tetrahedral complexes. 3

(b) The IR spectra for *trans*- $[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$ and *cis*- $[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$ show the following $(\text{Pd}-\text{N})$ and $(\text{Pd}-\text{Cl})$ vibrational frequencies in cm^{-1} :

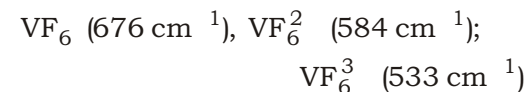
	$(\text{Pd}-\text{N})$	$(\text{Pd}-\text{Cl})$
<i>trans</i> - $[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$	496	333
<i>cis</i> - $[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$	495, 476	327, 306

Comment on the observed characteristic IR bands. 3

6. (a) There are no allowed transitions for $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ still it is pale pink in colour. Why? 1

(4)

(b) IR frequencies ($\nu_{\text{V-F}}$) in wave numbers (cm^{-1}) are furnished below for the following complexes. Comment on the differences in the observed IR frequencies : 3



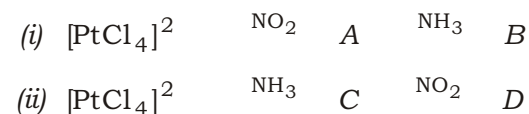
(c) Determine the term symbols for (i) $s^1 p^1$ and (ii) $d^1 s^1$. 2

SECTION—IV

7. (a) Define *trans*-effect and name two ligands with *trans*-directing effect. 3

(b) What is the general relation between overall stability constant and stepwise stability constant? 3

8. (a) Draw the stereochemistry of substitution of the following reactions :
 $1\frac{1}{2} \times 2 = 3$



- (b) Show that the inertness of a complex is different from its thermodynamic stability. 3

SECTION—V

9. (a) What do you understand by the term 'top-down' and 'bottom-up' methods in the synthesis of nanomaterials? Where are they used in nanotechnology? 3
- (b) Give one method of preparation of gold nanoparticles and give its applications. 3
10. (a) Name the different types of nano-material and mention their uses. 3
- (b) Give one method of preparation of silver nanoparticles and give its applications. 3

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