Seat No. : _____

JE-103

June-2022

M.Sc., Sem.-II

407 : Inorganic Chemistry

Time : 2 Hours] **[Max. Marks : 50**

Instructions : Section **I** : Answer any Three **(3)** questions out of Eight **(8)**
Section **II** : All questions are compulsory.
Illustrate your answers with neat diagrams/figures wherever necessary

SECTION – I

Answer any **three (3)** questions.

1. (A) Define Bent's rule. Discuss its applications on bond distance of different molecules. **(7)**
   (B) Calculate DE for 1,3-butadiene molecule. **(7)**

2. (A) Explain VSEPR theory and discuss the shape of PCl_3 and PCl_5 based on it. **(7)**
   (B) Explain valance state ionization potential. **(7)**

3. (A) Derive the two SALCs for AB2 (C_2V) type of molecule. **(7)**
   (B) In a molecule AB_3 (D3h), central atom A has s, p and d orbitals, what are the orbitals available on A which will form π-bonds with B. **(7)**

4. (A) Using symmetry arguments, assign the following vibrational frequencies to the stretching and bending vibrational frequencies obtained for NH_3 (C_{3V}) molecule. (Given : 1vib = $2A_1 + 2E$) **(7)**

IR cm^{-1}	Raman cm^{-1}
3523	3525 (depol)
3555	3555 (pol)
1022	1022 (depol)
1689	1690 (pol)

   (B) Find out I3N for ClF_3 (C_{2v}). **(7)**

5. (A) Write a note on Radio diagnostic agents and MRI. **(7)**
   (B) Discuss the discovery, use and mode of action of cisplatin. **(7)**

6. (A) Write a note on cytochrome P-450. **(7)**

(B) Discuss in detail Haemoglobin and Myoglobin and their role in body. **(7)**

7. (A) Discuss the effect of (a) Ionic Size (b) Ionic Charge (c) Electronegativity and (d) Class of Metal on the stability constant of Metal complex with example. **(7)**

(B) Discuss in details: Enzymatic reaction with electron transfer process is an example of Ternary Metal Complex reaction. **(7)**

8 (A) Discuss the effect of (a) Ratio of charge to size (b) Basic character/pH (c) Steric effect and (d) Chelation effect on the stability constant of Metal complex with example. **(7)**

(B) Discuss the principle and Current Voltage Curve of 'Polarographic Method' to determine Metal complex stability constant. **(7)**

SECTION – II

Answer the following questions (**1** mark each) **(8)**

9. (A) Which molecule/ radical is used to calculate N_{max} for Free valency in HMO theory ?

(B) What is the application of Walsh diagram?

(C) In $PtCl_4^{2-}$ (D4h), the irreducible representation of 'in plane bending' is A_{1g} + B_{2g} + Eu. What argument will you give to remove (redundant) A_{1g} which is not present in the balance ?

(D) In $POCl_3$ molecule, which stretching frequency will be the highest one ?

(E) Give the full name and structure of Auranofin.

(F) Give the name of naturally occurring organometallic compound in body.

(G) Define complex ion equilibria in aqueous solutions.

(H) How will you define 'Overall Stability Constant'?

SOME CHARACTER TABLES

C_{2v}	E	C_2	$\sigma_v(xz)$	σ'_v (yz)		
A_1	1	1	1	1	z	x^2, y^2, z^2
A_2	1	1	−1	−1	R_z	xy
B_1	1	−1	1	−1	x, R_y	xz
B_2	1	−1	−1	1	y, R_x	yz

C_{3v}	E	$2C_3$	$3\sigma_v$		
A_1	1	1	1	z	$x^2 + y^2, z^2$
A_2	1	1	−1	R_z	
E	2	−1	0	$(x, y)(R_x, R_y)$	$-y^2, xy)(xz, yz)$

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A'_1	1	1	1	1	1	1		$x^2 + y^2, z^2$
A'_2	1	1	−1	1	1	−1	R_z	
E'	2	−1	0	2	−1	0	(x, y)	$(x^2 - y^2, xy)$
A''_1	1	1	1	−1	−1	−1		
A''_2	1	1	−1	−1	−1	1	z	
E''	2	−1	0	−2	1	0	(R_x, R_y)	$', yz)$