

Total No. of Questions :6]

SEAT No. :

P2607

[5023]-12

[Total No. of Pages :5

M.Sc. (Part - I)

CH - 130: INORGANIC CHEMISTRY - I

(2008 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) Neat and labelled diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*

SECTION -I

Q1) Attempt any three of the following:

[15]

- a) Discuss the symmetry operations in the following point groups.
 - i) C_{3h} ii) C_{3v} iii) D_{2h}
- b) What are the conditions of mathematical group and explain them considering an example of $SOCl_2$ molecule.
- c) Give the stereographic projection of D_{5d} and C_{5h} point groups. Justify your answer.
- d) Write matrices for i and $C_2^{(y)}$ symmetry operations and show by matrix multiplication. $C_2^{(x)} \times C_2^{(y)} = C_2^{(z)}$.
- e) Draw possible isomers of $[Ma_3b_3]$ complex. Explain on the basis of symmetry which isomer is optically active.

P.T.O.

Q2) Attempt any three of the following:

[15]

- a) Using similarity transformation and multiplication table given below, group the symmetry operations in the appropriate classes.

C_2h	E	C_2	i	σ_h
E	E	C_2	i	σ_h
C_2	C_2	E	σ_h	i
i	i	σ_h	E	C_2
σ_h	σ_h	i	C_2	E

- b) Write out the characters of the representations of the following direct product and determine the set of irreducible representations which comprise them for the point group Td.

Direct product $E \times T_2$

Td	E	$8C_3$	$3C_2$	$6S_4$	$6\sigma_d$		
A_1	1	1	1	1	1		$x^2+y^2+z^2$
A_2	1	1	1	-1	-1		
E	2	-1	2	0	0		$zz^2-x^2-y^2, x^2-y^2$
T_1	3	0	-1	1	-1	R_x, R_y, R_z	
T_2	3	0	-1	-1	1	(x, y, z)	(xy, xz, yz)

- c) Sketch and describe all the symmetry operations in $B_3N_3H_6$ molecule and classify it into appropriate point group.
- d) Define the following terms with examples.
- Unit cell
 - Crystal lattice
 - Space lattice
 - Miller indices
 - Weiss indices

- e) Fill in the missing entries X, Y and Z in the following character table. Label the irreducible representations with appropriate Mulliken symbols.

	E	C_2^z	C_2^y	C_2^x
T_1	1	1	1	1
T_2	1	X	-1	-1
T_3	1	-1	Y	-1
T_4	1	-1	-1	Z

Q3) Attempt any two of the following: **[10]**

- a) Find out normalized SALC using projection operator of B_{1g} irreducible representation which operates on 61 orbital of XeF_4 molecule belonging to D_{4h} point group.

D_4	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
B_{1g}	1	-1	1	1	-1	1	-1	1	1	-1

- b) By schematic representation give the products of following symmetry operations in BrF_5 molecule.
- $\sigma_{v_1} \times \sigma_{d_1}$
 - $C_2' \times \sigma_{v_2}$
- c) For $[NiCl_4]^{2-}$ complex ion find the reducible representation for which sigma bond form the basis and find out which orbitals from central ion will be offered for sigma bonding.

Given: the character table for T_d in question no. 2(b).

SECTION -II

Q4) Answer any three of the following: **[15]**

- a) Explain with suitable examples following reactions of organometallic compounds.
- β hydrogen elimination
 - Lewis acidity
 - Oxidation reaction

- b) Give an account of carbides of Boron.
- c) Give characteristic reactions of COCl_2 .
- d) Give an brief account of nitrogen activation.
- e) Mention the position and relative abundance of noble gases in earth crust. Why is helium present in low concentration in atmosphere. Give applications of noble gases.

Q5) Write notes on any three of the following: **[15]**

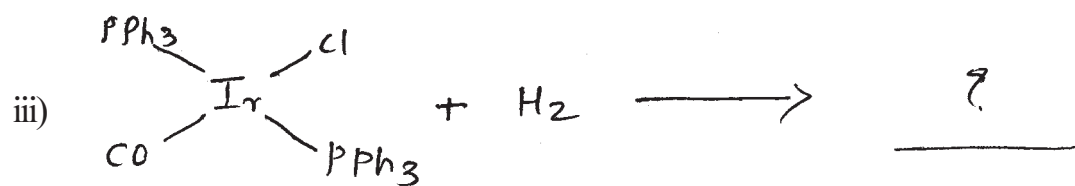
- a) Oscillating reactions.
- b) Oxyacids of sulphur.
- c) Lead acid battery.
- d) Electron rich compounds.
- e) Metal compounds of fullerenes.

Q6) a) Draw any five structures: **[5]**

- i) P_4O_{10}
- ii) $\text{B}_3\text{N}_3\text{H}_6$
- iii) Ge_6R_6
- iv) $\text{Mn}_2(\text{CO})_{10}$
- v) B_6H_{10}
- vi) $\text{Li}_4(\text{CH}_3)_4$.

b) Complete any five reactions: **[5]**

- i) $\text{LiAlH}_4 + \text{SiCl}_4 \rightarrow \underline{\hspace{2cm}}?$
- ii) $\text{PCl}_5 + \text{KF} \rightarrow \underline{\hspace{2cm}}?$



EEEE