

Total No. of Questions :6]

SEAT No. :

P2905

[Total No. of Pages :3

[5023] - 1002

M.Sc. I

INORGANIC CHEMISTRY

**CHI - 130 : Molecular Symmetry and Chemistry of P - Block Elements
(2014 Pattern) (New) (4 Credit) (Semester - I)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Answer to the two sections should be written in separate answer books.*
- 3) Figures to the right indicate full marks.*
- 4) Use of log tables / character tables and calculator is allowed.*

SECTION - I

Q1) Answer the following: [10]

- a) What is the point group symmetry of cyclopentane and cyclobutane?
- b) Find the product of $\sigma \times 4 \times c_2^z$ using cartesian coordinates.
- c) Write down all the associative operations with S_5 axis.
- d) How do you distinguish between C_{4v} and C_{4h} point groups. Using suitable examples?
- e) Identify and draw different types of planes in NO_3^- ion.

Q2) Attempt any two of the following: [10]

- a) Write the matrices for C_2^x , C_2^y and C_2^z . Find the product of the following using matrix multiplication:
 - i) $C_2^x \times C_2^y$
 - ii) $C_2^y \times C_2^z$
 - iii) $C_2^x \cdot C_2^z$
- b) Sketch and describe all symmetry operations in MnO_4^- ion. Justify it and find out the point group.

P.T.O.

- c) Derive the character table for D_{2h} point group using great orthogonality theorem.
- d) List all the possible symmetry elements for trans dichloroethylene molecule and show that they form a mathematical group.

Q3) Attempt any one of the following: **[5]**

- a) For PCl_5 considering sigma band as a basis of representation find the reducible representation and find out the orbitals that are offered for sigma bonding.
- b) Find out the normalized SALC using projection operator of E_u irreducible representation which operates an σ_1 orbital of the $[Cu(NH_3)_4]^{2+}$ complex ion.

D_{4h}	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
E_u	2	0	-2	0	0	-2	0	-2	0	0

SECTION - II

Q4) Answer the following: **[10]**

- a) BF_3 is a hard Lewis acid. Explain.
- b) Name different Pseudohalogens and corresponding halogens.
- c) Mention different crown ethers used for extraction of alkali metals.
- d) Borazole is called as inorganic benzene. Explain.
- e) What are electron precise hydrides? Explain with example.

Q5) Attempt any two of the following: **[10]**

- a) Write a note on molecular sieves.
- b) Give an account of oxanions of nitrogen.
- c) What are intercalation compounds of graphite? Explain with example
- d) Give an account of oxoanions of halogens.

Q6) Draw any five structures.

[5]

- a) $B_5 Hg$
- b) $Al_2 Cl_6$
- c) IF_5
- d) $Li_4 (CH_3)_4$
- e) $AS_4 O_{10}$
- f) $S_2 N_2$
- g) $B_3 N_3 H_3 Cl_3$

Given :

Character Table for D_{3h} Point Group

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A_1^1	1	1	1	1	1	1		$x^2 + y^2 + z^2$
A_2^1	1	1	-1	1	1	-1	R_z	
E^1	2	-1	0	2	-1	0	(x, y)	$(x^2 - y^2, xy)$
A_1^{11}	1	1	1	-1	1	1		
A_2^{11}	1	1	-1	-1	-1	1	z	
E^{11}	2	-1	0	-2	1	0	(R_x, R_y)	(xz, yz)

