Total No. of Questions :6]

SEAT No. :

P1899

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[5223] - 1002

M.Sc. - I

INORGANIC CHEMISTRY

CHI-130: Molecular Symmetry and Chemistry of P - block Elements

(2014 Pattern) (Semester - I) (4 Credit System)

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 in cyclopentadienyl anion ($C_5H_5^-$) and Benzene?

b) When n is odd, $S_n^n \equiv \sigma$. Prove this.

c) Draw the structure of PCL_5 molecule and identity different types of planes in it.

d) Find out the product of $C_3^1 \times C_3^2$ in BF_3 molecule and also find whether they commute with each other or not.

e) Mention the symmetry elements, order and classes of Td point group.

Q2) Answer any two of the following : **[10]**

a) Explain all the symmetry elements present in the molecule $XeOF_4$ and assign the correct point group.

b) Define Abelian group. Prove that C_{2v} point group is an Abelian group.

P.T.O.

c) Derive the character table for D_2 point group using great orthogonality theorem and assign Mulliken symbols to the irreducible representations.

d) Give the matrix representation for improper axis of rotation and using matrix multiplication prove,

$$S_2 = C_2(z) \times \sigma_{xy} = i$$

Q3) Answer <u>any one</u> of the following : **[5]**

a) Find the reducible representation for $[PdCl_4]^{2-}$ molecule considering σ - bond as a basis of representation and thus find out the orbitals offered for σ - bond formation in the molecule.

b) Find out the normalized SALC using projection operator of E^1 irreducible representation on σ_1 orbitals of CO_3^{2-} ion.

D_3h	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$
E′	2	–1	0	2	–1	0

SECTION - II

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

a) Alkali metal solution is a good conductor of electricity in liquid ammonia. Explain.

b) Give classification of hydrides of Boron.

c) Give the preparation methods for dihydrogen.

d) What are allotropes of carbon? Draw the structure of Metal - fullerene.

e) What is activation of nitrogen? Explain any two methods of activation.

Q5) Attempt <u>any two</u> of the following : **[10]**

a) Write a note on interhalogen compounds.

b) What are organometallic compounds? Explain organometallic compounds of Lithium with synthesis, properties, structure and uses.

c) Write a note on carbon nano tubes.

d) What are oxyacids? Explain oxyanions of halogens.

Q6) Attempt any one of the following : **[5]**

a) Explain the structure and bonding in

i) Ammonia.

ii) B_4H_{10}

b) Draw the structures of following :

i) ClF_5

ii) B_5Hg

iii) 18 - crown - 6

iv) $Li_4(CH_3)_4$

v) PH_3

Character table for D_{4h} point group.

D_{4h}	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	L	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$		
A_{1g}	1	1	1	1	1	1	1	1	1	1		x^2+y^2,z^2
A_{2g}	1	1	1	–1	–1	1	1	1	–1	–1	R_z	
B_{1g}	1	–1	1	1	–1	1	–1	1	1	–1		$x^2–y^2$
B_{2g}	1	–1	1	–1	1	1	–1	1	–1	1		xy
Eg	2	0	–2	0	0	2	0	–2	0	0	(R_x,R_y)	(xz,yz)
A_{1u}	1	1	1	1	1	–1	–1	–1	–1	–1		
A_{2u}	1	1	1	–1	–1	–1	–1	–1	1	1	z	
B_{1u}	1	–1	1	1	–1	–1	1	–1	–1	1		
B_{2u}	1	–1	1	–1	1	–1	1	–1	1	–1		
E_u	2	0	–2	0	0	–2	0	2	0	0	(x,y)	

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