AB-157

April-2019

M.Sc., Sem.-II

407 : Chemistry

(Inorganic Chemistry)

Time : 2:30 Hours]   **[Max. Marks : 70**

1. (A) Answer the following questions :
   - (i) State Bent's rule. Discuss its applications on bond length of different fluoromethane.   7
   - (ii) Explain PPP approximation.   7

   OR
   - (i) Calculate DE for benzene molecule.
   - (ii) Discuss the shape of PCl_3, PCl_5, PCl_4^+ and PCl_6^- on the basis of VSEPR theory.

   (B) Answer in **one** or **two** lines : (any **four** out of **six**)   4
   - (1) What is the bond angle of NH_2 molecule according to Walsh diagram ?
   - (2) What is the Prs value for benzene molecule according to HMO theory ?
   - (3) Define Fermi level.
   - (4) What is the value of α_{ij} in SCF method ?
   - (5) Explain VSIP.
   - (6) What are super-conductors ?

2. (A) (i) State the 'Selection Rule'. Explain it by taking suitable examples.   7
   - (ii) Find out reducible representations for fundamental modes of vibrations for Trans-dichloroethylene (C_{2h}). Discuss their IR and Raman activities.   7

   OR
   - (i) Find out Symmetry Adopted Linear Combinations for H_2O (C_{2v}) molecule.
   - (ii) Determine its hybridization for σ-bonding in AB_5 (C_{4v}) molecule.

   (B) Answer any **four** questions in **one** or **two** lines from the following.   4
   - (1) How many vectors will be there for bonding in ClO_4^- ion ?
   - (2) What will be the hybridization for σ-bonding in $Ni(CO)_4$ molecule ?
   - (3) List the symmetry operations of Td point group in class wise manner.
   - (4) Write the reducible representation for $T_1 + T_2$ in Td point group.
   - (5) What is the value of χ (sum of the elements along the diagonal axis) in the matrix of Cn operation ?
   - (6) State Mutual Exclusion rule.

3. (A) (i) Discuss synthesis and uses of OMCs of π-bonding 2-electron organic ligands. 7

(ii) Discuss the Role of OMCs in the catalytic reaction. 7

OR

(i) Discuss the transition metal-butadiene compounds.

(ii) Explain the stability of metal-carbon bond in organometallic compounds.

(B) Answer any **three** questions in **one** or **two** lines from the following. 3

(1) Give example of OMC where multidentate ligand combined as monodentate.

(2) Write the type of complex when two metal atoms are within the bonding distance of one carbon atom.

(3) Give an example of bridge ligand complex.

(4) By which process hydrated electrons are produces ?

(5) State the oxidation state of Cr in di-benzene chromium.

4. (A) (i) Describe the effect of temperature, nucleophile and solvent on reaction mechanism. 7

(ii) Discuss the kinetics of substitution reaction of platinum (II) complexes of square planar complexes. 7

OR

(i) Discuss Marcus-Hush theory.

(ii) Define unstable oxidation state and its application.

(B) Answer any **three** questions in **one** or **two** lines from the following. 3

(1) Give the formula for nuclear factor in Marcus equation.

(2) What is outer sphere reaction ?

(3) Give an example of one equivalent redox reaction.

(4) Give the order of energy of nucleophilic attraction

(5) Define complementary redox reaction.

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SOME CHARACTER TABLES

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

C_{4V}	E	$2C_4$	$C;$	$2\sigma_V$	$2\sigma_C$		
A_1	1	1	1	1	1	z	$x^2 + y^2$
A_2	1	1	1	−1	−1	R_z	
B_1	1	−1	1	1	−1		$x^2 - y^2$
B_2	1	−1	1	−1	1		xy
E	2	0	−2	0	0	$(x, y)\ (R_x, R_y)$	(xz, yz)

C_{2h}	E	C_2	i	σ_h		
A_g	1	1	1	1	R_z	x^2, y^2, z^2
B_g	1	−1	1	−1	R_x, R_y	xz, yz
A_u	1	1	−1	−1	z	
B_u	1	−1	−1	1	x, y	

T_d	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	$(2z^2 - x^2 - y^2, (x^2 - y^2)$
E	2	−1	2	0	0	
T_1	3	0	−1	1	−1	(R_x, R_y, R_z)
T_2	3	0	−1	−1	1	$(x, y, z)\quad (xy, xz, yz)$