

Seat No. : _____

OA-127

October-2018

M.Sc., Sem.-II (Repeater)

**407 : CHEMISTRY
(Inorganic Chemistry)**

Time : 2:30 Hours]

[Max. Marks : 70

1. (A) Compare the stability of cation, free radical and anion of cyclopentadiene based on their delocalization energy. 14
- OR**
- (i) Explain VSEPR theory. 7
- (ii) Discuss the properties of insulators, semiconductors and superconductors. 7
- (B) Answer any **four** questions in one or two lines from the following : 4
- (1) Define electron density.
- (2) What is the use of Bent's rule ?
- (3) Define Fermi level.
- (4) What is the use of Walsh diagram ?
- (5) Why VSIP of 2s orbital of oxygen atom is greater than that of 2p orbital ?
- (6) Give one example of a molecule of the type AX_2E_2 according to VSEPR theory.
2. (A) s, p and d- orbitals of Pt^{2+} atom in $PtCl_4^{-2}$ (D_{4h}) are available for the hybridization. Determine its hybridization for σ -bonding and π -bonding. 14
- OR**
- (i) Find out reducible representations for $13N$ for MnO_4^- (T_d). Discuss their IR and Raman activities. 7
- (ii) Find out SALC for AB_n type of molecule by applying five steps. 7
- (B) Answer any four questions in one or two lines from the following : 4
- (1) For a molecule with point group C_{2v} , write down a representation which is totally symmetric.
- (2) What will be the hybridization for σ -bonding in CCl_4 and MnO_4^- ?
- (3) What will be the contribution value of $\chi(R)$ for a unit vector when it is subjected to an operation in which it remains unshifted but only its direction is changed ?
- (4) Write the reducible representation for $E + T_2$ in T_d point group.
- (5) Which of the following frequency will be totally symmetric in the case of AB_4 molecule (T_d): 1102 (depol), 935 (pol), 628 (depol), 462 (depol) cm^{-1} ?
- (6) What is Mutual Exclusion rule ?

3. (A) Write a note on activation of small organic molecules by organometallic compounds. 14

OR

- (i) Discuss the stability of metal-carbon bond in organometallic compounds. 7
- (ii) Discuss the general synthesis of organometallic compounds. 7
- (B) Answer any **three** questions in one or two lines from the following : 3
 - (1) What is a catalyst ?
 - (2) Give example of OMC where multidentate ligand combined as monodentate.
 - (3) What is organometallic compound ?
 - (4) Write the type of complex when two metal atoms are within the bonding distance of one carbon atom.
 - (5) Give an example of bridge ligand complex.

4. (A) Describe the leaving group, charge, steric effect, solvent effect on reaction mechanism. 14

OR

- (i) Discuss the substitution reaction mechanism of square planar complexes. 7
 - (ii) Discuss Tunnelling effect. 7
 - (B) Answer any **three** questions in one or two lines from the following : 3
 - (1) Write the correct order of energy of nucleophilic attraction.
 - (2) What is inner sphere reaction ?
 - (3) Give an example of one equivalent redox reaction.
 - (4) Does reaction rate always increase as the free energy change becomes more negative ?
 - (5) Define "Inverted region" – result of Marcus theory.
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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_z	xy
B_1	1	-1	1	-1	x, R_y	xz
B_2	1	-1	-1	1	y, R_x	yz

D_{4h}	E	$2C_4$	C_2	$2C'_2$	$2C''_2$	i	$2S_4$	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
E_g	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)

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

