

XK (II) - Ch (6)

2012-14
(Second Semester)

Full Marks : 80

Time : 3 hours

The figures in the right-hand margin indicate marks

Answer **four** questions including Question 1 which is compulsory

1. Explain the following : 5×4

(a) CO coordinates through C and not through O in metal carbonyls.

(b) d^2 and d^8 have the same spectroscopic terms.

(c) H_2O belongs to Abelian group.

(d) The Ni—C bond order in $Ni(CO)_4$ is 1.5.

2. (a) What are requirement of a mathematical group? Explain with example of C_{3v} point group (NH_3). 15

(b) Show that C_{3v} point group is not an Abelian group. 5

3. (a) Write the total symmetry operations of the following molecules : 5×3

(i) PCl_5

(ii) $Ni(CO)_4$

(iii) C_6H_6

(iv) $(C_6H_6)_2Cr$

(v) Staggered ethane.

(b) Assign their point group. 5

4. (a) Derive the spectroscopic terms for a d^2 system and show that their total microstatics is 45. 6+2

(b) Draw the Orgel diagram of 4F term of d^3 and d^7 systems in octahedral and tetrahedral crystal field. 6+6

5. (a) Define Racah parameter (B) and nephelauxetic effect (β). 2×2½

(b) $[Ni(H_2O)_6]^{3+}$ displays three bands in its electronic spectra— $\gamma_1 = 8700 \text{ cm}^{-1}$, $\gamma_2 = 14200 \text{ cm}^{-1}$ and $\gamma_3 = 24000 \text{ cm}^{-1}$.

(i) Assign these band.

(ii) Derive $10 Dq$.

(iii) Derive B and β . 3×5

(Continued)

6. (a) Draw MO diagram for N_2 molecule. 6
- (b) What orbitals of N_2 are involved in bonding in dinitrogen complexes? Give an application of a dinitrogen complex explaining the catalytic cycle involved. 6+8 (

7. (a) Draw the MO diagram for CO molecule. 8
- (b) Show the bonding in metal carbonyls and explain the phenomenon of backbonding. 12

8. (a) What are metal nitrosyls? Give one method of preparation of metal nitrosyl. 3+5

- (b) Describe the bonding in metal nitrosyls. 12
