

FACULTY OF SCIENCE

M. Sc I Semester Examination, January 2018

Subject: CHEMISTRY

Paper-I

INORGANIC CHEMISTRY

Time: 3 Hours

Max. Marks: 80

Note: Answer all questions from Section-A and Section-B. Each question carries 8 marks in Section A and 12 Marks in Section-B.

SECTION-A (4X8=32 Marks)
(Short Answer Type)

- 1 (a) Describe C_3 and S_3 operations in BF_3 molecule with diagrams.
(b) Illustrate various types of planes in molecules of D_{6h} point group.
- 2 (a) Discuss the salient features of crystal field theory.
(b) Draw crystal field splitting diagram for square planar and pentagonal bi-pyramidal geometries.
- 3 (a) Write the principle of pH-metry for the determination of stability constant and explain its method for determination of dissociation constant of a monoprotic ligand (HL).
(b) Discuss any two metal ion effect on stability constants of metal complexes.
- 4 (a) Compare acceptor and donor properties of CO and N_2 with illustration through their molecular orbital energy level diagram.
(b) Discuss the application of 18 electron rule in linear and bridging metal nitrosyls with two example of each type.

SECTION-B (4X12=48 Marks)

- 5 (a) Discuss the following
 - (i) S_n operations in O_h point group
 - (ii) C_n operations in benzene molecule
 (b) Discuss the concept of symmetry for dipole moments and explain with suitable examples.

OR

 (c) Give an illustration of various symmetry operations in eclipsed and staggered forms of ethane (C_2H_6).
(d) Give an illustration of symmetry operations of following point groups
(i) S_4 and (ii) T_d
- 6 (a) Write example of octahedral complex with d^4 , d^5 , d^6 and d^7 high spin and low spin configurations and calculate crystal field stabilization energy in each.
(b) Discuss a method for the determination of magnetic susceptibility.

OR

 (c) (i) Explain the concept of weak and strong fields.
(ii) Calculate magnetic moment values in (i) $[V_9CO]_6$ (ii) $[Fe(CN)_6]^{3-}$ and $[Ni(CN)_4]^{2-}$
(d) Explain about quenching of orbital angular momentum and Jahn Teller theorem.

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- 7 (a) Describe the principle of polarographic method for the determination of stability constants.
(b) What is macrocyclic effect? Explain with examples.
OR
(c) Describe the principle and method of Spectrophotometry for the determination of stability constants.
(d) Discuss the below given influencing factor of stability constants:
(i) Jahn teller effect (ii) Ionization potential of metal ions and (iii) Substituent on ligand
- 8 (a) Explain the chemical fixation of dinitrogen.
(b) Explain the structural features of (i) $[\text{IrCl}(\text{PPh}_3)_2(\text{CO})(\text{NO})]^+$ and (ii) Ru(II) dinitrogen complexes.
OR
(c) Explain the concepts of stereochemical control of valence in metal nitrosyls.
(d) Explain about two experimental evidences that support back bonding in metal carbonyls.

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