

FACULTY OF SCIENCE

M.Sc. I – Semester Examination, Dec. 2018 / Jan. 2019

Subject: Chemistry

Paper – I

Inorganic Chemistry

Time: 3 Hours

Max.Marks: 80

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

PART – A (4x8 = 32 Marks)

[Short Answer Type]

- 1 a) Write a short notes on proper axis of rotation. Illustrate with example.
b) Find out the symmetry elements present in the following point groups:
 C_{2v} , C_{3v} , D_{3h} , O_h , T_d
- 2 a) Square planar complexes of Ni(II) show diamagnetic behavior while tetrahedral complexes of Ni(II) are paramagnetic. Explain.;
b) Explain the Jahn-Teller theorem and discuss how it is helpful to deal with distortion in Cu(II) complexes.
- 3 a) Discuss briefly on the Pearsons' concept of hard and soft acids and bases.
b) Explain how the solvation effects account for anomalous natures of acids and bases using suitable example.
- 4 a) Describe the preparation and bonding in metal dinitrogen complexes.
b) Discuss the application of 18 electron rule in linear and bridging metal carbonyls with two examples of each type.

PART – B (4x12 = 48 Marks)

[Essay Answer Type]

- 5 a) Why do BF_3 and ClF_3 molecules belong to different point groups. Assign their point groups and list out the symmetry elements.
b) Identify the symmetry elements present in the following molecules and assign the appropriate point groups: $[CoCl_4]^{2-}$, dichloro methane, HCN, $XeOF_4$ and CH_3Cl .

OR

- c) Discuss the classification of molecules into different point groups and mention the point groups in each class.
- d) Discuss the concept of symmetry criteria for optical activity.

- 6 a) What is crystal field stabilization energy? Calculate CFSE for
i) $[\text{CoF}_6]^{3-}$ ii) $[\text{Co}(\text{NH}_3)_6]^{3+}$ iii) $[\text{Fe}(\text{CN})_6]^{3-}$
b) What are high-spin low-spin complexes? Explain with suitable examples.

OR

- c) How does the d-orbital splitting change as an octahedron becoming a square planar complex. Explain.
d) Discuss the Gouy method for the determination of magnetic susceptibility.

- 7 a) What are stepwise and overall stability constants? Explain their relationship.
b) Describe the principle of pH metric method for the determination of stability constant of a complex.

OR

- c) What is cryptate effect? Explain with examples.
d) Discuss the below given influencing factor of stability constants
i) Basicity
ii) Steric effects on ligands
iii) Crystal field effect and
iv) Ionization potential on metal ion.

- 8 a) Explain the carbon monoxide as a ligand and discuss the bonding modes of CO.
b) Explain the stereochemical control of valence in metal nitrosyls
i) $[\text{Co}(\text{diars})_2(\text{NO})]^{2+}$ and
ii) $[\text{Co}(\text{diars})_2\text{NO}(\text{SCN})]^+$.

OR

- c) Explain the bonding modes and structures of Ru(II) and Os(II) dinitrogen complexes.
d) What is 18 electron rule? Explain the molecular orbitals of NO.
