M.Sc. (Part—I) Semester—I (C.B.C.S. Scheme) Examination

CHEMISTRY (Old)

(Upto Summer–2018)

(Inorganic Chemistry—I)

Paper—I

Time : Three Hours] [Maximum Marks : 80

N.B. :— (1) **All** questions are compulsory and carry equal marks.

(2) Use of scientific calculator is allowed.

1. (A) Giving appropriate stereochemical rules of VSEPR theory, explain the shape of the following :

(i) SF_4

(ii) ICl_4^- and PCl_5. 6

(B) What is Bent's Rule ? Using it explain the following :

(i) Bond angle decreases in the order :

H – C – H > H – C – Cl > Cl – C – Cl

(ii) In trigonal bipyramid molecule, more electronegative atom attached axial rather than equatorial positions. 5

(C) Discus molecular energy level diagram of CO molecule and explain its σ donor and π acceptor tendency. 5

OR

(P) Discuss MO diagram of Benzene molecule in brief. 6

(Q) In CH_4, NH_3 and H_2O molecules bond angle is decreasing. Explain giving reasons on the basis of VSEPR theory. 5

(R) Mention the type of hybridisation and shapes of following :

(i) SiF_4

(ii) H_2S

(iii) BF_3

(iv) IF_7

(v) NO_2^+ 5

2. (A) Explain abnormal magnetic properties in octahedral complexes giving suitable examples. 6

(B) Explain high spin-low spin cross-over by using suitable examples. 5

(C) Discuss the distortion of the octahedron of a Cu^{++} complex in terms of Jahn-Teller effect. 5

OR

(P) Indicate the splitting of d-levels and the number of electrons in d-level in the following complexes :

(i) High spin $[Mn(H_2O)_6]^{2+}$

(ii) Low spin $[Fe(CN)_6]^{4-}$

(iii) Tetrahedral $[CuCl_4]^-$. 6

(Q) Give limitations of crystal field theory. 5

(R) What are the conditions required for orbital contribution in magnetic moment ? In which of the following configuration do you expect orbital contribution :

$(t_{2g})^2(eg)^o$ $(t_{2g})^3(eg)^o$? 5

3. (A) Draw topological sketches for following molecules in terms of styx number :

(i) B_2H_6

(ii) B_5H_9

(iii) B_4H_{10}

(iv) B_3H_9. 6

(B) Discuss structure and bonding in pentaborane –11. 5

(C) What are metal clusters ? Explain structure of binuclear and trinucler metal clusters. 5

OR

(P) Describe synthesis and properties of sulphur-nitrogen compounds. 6

(Q) Discuss structure and bonding in diborane. 5

(R) What are isopoly and heteropoly acids ? Explain it w.r.t. Mo and W. 5

4. (A) Describe the Irwin-Rossotti pH metric method of determination of stability constant of complex. 6

(B) What is chelate effect ? Explain its thermodynamic origin. 5

(C) Explain any two inorganic reactions in anhydrous sulphuric acid medium. 5

OR

(P) Derive the relationship between stepwise stability constant (K_n) and overall stability constant (β_n). 6

(Q) Give an account on Molten salts as nonaqueous solvent. 5

(R) Discuss acid-base and Solvolysis reaction in non-aqueous BrF_3 solvent. 5

5. (A) Identify the symmetry point group in the following :

(i) PCl_5

(ii) H_2O

(iii) CO_2

(iv) BeF_2

(v) trans H_2O_2 and

(vi) NH_3. 6

(B) Explain the reducible and irreducible representations. 5

(C) Explain the terms symmetry elements and symmetry operations with suitable example. 5

OR

(P) Show that $S_2 = C_2^z \times \sigma^{xy}$ by vector method. 6

(Q) Discuss all the symmetry operations in CH_4 molecule. 5

(R) Derive the character table for C_{2v} point group. 5