



**I Semester M.Sc. Degree Examination, May 2014**  
**(Semester Scheme)**  
**CHEMISTRY**  
**Inorganic Chemistry – I**

Time : 3 Hours

Max. Marks : 80

**Instruction :** Answer **any eight** sub-questions from question No. 1 and **any four** of the remaining.

1. Answer **any eight** of the following :

**(8×2=16)**

- a) How are  $\sigma$ -,  $\pi$ - and  $\delta$ - molecular orbitals formed ?
  - b) Draw the topological structure of pentaborane-9 and find its B-B, B-H, B-H-B and B-B-B bonds.
  - c) The radii of  $Mg^{2+}$  and  $S^{2-}$  are 0.66 and 1.84 Å, respectively. Predict the most probable crystal structure for MgS.
  - d) Give the expression for Kapustinskii's equation and indicate the terms involved.
  - e) NaCl do not favour Frenkel defect, while AgCl does it. Why ?
  - f) Distinguish 'n' and 'p' type semiconductors.
  - g) State Lux-Flood concept of acids and bases. Give an example for each.
  - h) What are leveling and differentiating solvents ?
  - i) Strong oxidizing agents apparently do not exist in liquid ammonia. Why ?
  - j) Urea is an acid in liquid ammonia but a base in glacial acetic acid. Account for this.
2. a) How does the property that Pauling defines as electronegativity vary within the periodic table ?
- b) Write briefly on the concept of resonance by taking carbonate and thiocyanate as examples.
- c) What are the postulates of VSEPR model ? Based on it, explain the shapes of  $ClF_3$ ,  $SF_4$  and  $PF_5$ .

**(4+6+6=16)**

P.T.O.



3. a) Outline the preparation of diborane and explain its structure and bonding.  
b) Set up MO energy level diagrams for oxygen and nitrogen molecules.  
Rationalize why the N-N bond distance in  $N_2^+$  is longer than in  $N_2$ .  
c) State radius ratio rule. Deduce limiting ratio for octahedral and tetrahedral coordination. **(4+6+6=16)**
4. a) Explain the criteria for the formation of stable ionic compounds.  
b) Discuss Fajan's rules for understanding the existence of covalent character in ionic compounds.  
c) Derive Born-Landé equation and show how the lattice energy of NaCl crystal is determined. **(4+6+6=16)**
5. a) Write briefly on the non-stoichiometric defects in solids.  
b) Discuss various types of supramolecular interactions with an example for each type.  
c) Based on band theory, explain how solids can be classified as conductors, semiconductors and insulators. **(4+6+6=16)**
6. a) Give the Usanovich concept of acids and bases and outline its salient features.  
b) What is hydrogen bonding? Explain the effects of hydrogen bonding. How IR spectroscopic technique is useful in detecting hydrogen bonding?  
c) How does  $N_2O_4$  auto-ionize? Describe its role in preparing anhydrous metal nitrates. **(4+6+6=16)**
7. a) What is the relation between the dipole moment of a liquid and its solvating power?  
b) Write physical properties of liquid sulfur dioxide and discuss different types of chemical reactions involved in it.  
c) Discuss briefly on the Pearson's concept of hard and soft acids and bases. Based on it, Will  $Cu^{2+}$  react more strongly with  $HO^-$  or  $NH_3$ ? With  $O^{2-}$  or  $S^{2-}$ ? **(4+6+6=16)**