LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – CHEMISTRY

FIRST SEMESTER – NOVEMBER 2007

CH 1807 - CONCEPTS IN INORGANIC CHEMISTRY

AD 15

Date : 27/10/2007   Dept. No.   Max. : 100 Marks
Time : 1:00 - 4:00

Part-A
*Answer **all** questions. Each question carries **two** marks*

1. The ionization energy of H is 1312 kJ mol^{-1} whereas that of Li is 520 kJ mol^{-1}. Account for this difference.

2. Mention the ionic crystal lattices that have cubic space group *Fm3m*.

3. Al always exists as Al^{3+} in ionic crystals despite the fact that it costs 5140 kJ mol^{-1} to remove the electrons from the atom. Explain.

4. What is "isolobel analogy"? Mention its significance.

5. In trigonal bipyramidal and square pyramidal geometries the equatorial bonds are stronger and shorter than the axial ones. Give reason.

6. The symmetry of BH_3 is D_{3h} while that of NH_3 is C_{3v} despite the fact that both B and N have coordination number 3. Comment upon this observation.

7. The composition of clathrates are, in general, variable. Rationalize.

8. The soft base sulfite ion displaces the hard base, F^-, from the hard acid, H^+. Explain with an example.

9. What are associated molecules? Cite two examples.

10. Give the unit cell parameters of monoclinic and rhombic crystal systems.

Part-B
*Answer **eight** questions. Each question carries **five** marks*

11. The enthalpy of atomization of Cu is 338 kJ mol^{-1} and that of chlorine is 121 kJ mol^{-1}. The first and second ionization potential of Cu is 746 and 1958 kJ mol^{-1}, respectively. Lattice energy of CuCl is -973 kJ mol^{-1} and that of $CuCl_2$ is -2772 kJ mol^{-1}. Compute the enthalpy of formation of CuCl and $CuCl_2$ and comment upon their stability.

12a. Calculate the radius ratio of sodium chloride lattice and cite the limiting radius ratio for the different lattice structures.
  b. The radius of Be^{2+} is 59 pm and that of S^{2-} is 170 pm. Predict the structure of BeS.

13a. Explain leveling effect with an example.
  b. How is the stability of complexes formed between acids and bases predicted?

14. Differentiate electron rich, electron precise, and electron deficient molecules with an example each.

15. Explain the principles of VSEPR model and predict the structure of (a) BrF_3 and   (b) SF_4.

16. Illustrate Bent's rule with two examples.

17. Give an account of acids and bases with respect to (a) classification and (b) stability of the complexes formed between them.

18. Give an account of imperfection in ionic lattices and the unusual properties and applications of such defect lattices.

19. Explain the structural features of (a) rutile and (b) wurtzite.

20a. What are inclusion compounds? How are they classified?
   b. Write a note on the structural aspects of hydronium ion in gas phase.

21. Explain the principle of conservation of atomic orbitals in polar molecules with the aid of MO theory by constructing the qualitative MO energy level diagram.

22. Explain the packing of ions in crystal lattices and the structures of ionic lattices.

Part-C
*Answer **four** questions. Each question carries **ten** marks*

23a. Explain the principles of LCAO method.
   b. Construct the qualitative MO energy level diagram of BeH_2. How is this MO energy level diagram different from that of other heterodiatomic molecules such as NO?

24a. Explain the Band theory of metals and account for the metallic properties.
   b. Give an account of impurity semiconductors in the light of band theory.

25a. Derive Born-Lande equation to compute the lattice energy.
   b. How do you account for the solubility of ionic compounds in polar solvents.

26 Give an account of aprotic solvents with particular reference to (a) their tendency toward coordination with cations, (b) donor ability and electrophilic behavior, (c) polarity and autoionization, and (d) leveling and nonleveling solvent systems.

27a. Explain the principle of X-ray diffraction.
   b. Discuss the structure factor and its use in solving crystal structures.

28a. Give an account of the solvent properties of molton salts and reactions in such media.
   b. Explain the salient features of ionic liquids and highlight the importance of ionic liquids as solvents for chemical reactions.

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