LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - CHEMISTRY

FIRST SEMESTER – NOVEMBER 2013

CH 1807/1813 - CONCEPTS IN INORGANIC CHEMISTRY

Date : 08/11/2013   Dept. No.   Max. : 100 Marks
Time : 1:00 - 4:00

Part-A

*Answer **all** questions. Each question carries **two** marks.*

1. The atomic radius of gallium (atomic number 31) is 121 pm, whereas that of aluminium (atomic number 13) is 142pm. Rationalize.

2. The ionization energy of H is 1,312 kJ mol^{-1}, whereas that of Li is 520 mol^{-1}. Account for this observation.

3. LiF is the least soluble alkali fluoride and CsI is the least soluble alkali iodide. Offer a resonable explanation.

4. When the cation and anions are of approximately the same size, which is the most preferred crystalstructure?

5. What is isolobel analogy? Mention its significance.

6. Citing examples explain permanent and induced dipole moment.

7. Aluminium always exists as Al^{3+} in its ionic compounds despite that fact that it costs 5,140 kJ mol^{-1} to remove the three electrons from the atom. Explain.

8. $CaCO_3$ and $CdCO_3$ decompose at 900 and 350 °C, respectively, despite the fact that both Ca^{2+} and Cd^{2+} have the same size. Offer a reasonable explanation.

9. 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 the same coordination number. Give reason.

10. Cite an inclusion compound of nature.

Part-B

*Answer **eight** questions. Each question carries **five** marks.*

11a. Explain Slater's method of approximating the radial function for real atom.

  b. Highlight Slater's empirical rules for calculating the shielding constant.

12a. In a lattice of closest packed anions how do you calculate the size of an octahedral hole?

  b. What is critical radius ratio? Mention its significance. Cite the optimum radius ratio range for crystal structures of coordination numbers 4, 6, and 8.

13a. Schematically represent π-molecularorbitals formed by the overlap of *d*-orbitals.

  b. What is variable hybridization? Illustrate with an example.

14. Explain hydrogen bonding and describe the structure of ice.

15. Discuss the reaction of metals in liquid ammonia.

16. Explain leveling effect with an example.

17. Account for the existence of nitrosyl ion (NO^+) in several compounds in the light of MO theory.

18. Explain the various scales of electronegativity.

19. What are the properties of acetic acid in water and acetic acid in CCl_4.

20. What are superacids? Give preparation of any one superacid.

21. What are electron density counter diagrams? How is the effect of polarization illustrated with the aid of such diagrams?

22. Illustrate the principle of conservation of atomic orbitals in heteroatomic molecules with the help of MO theory.

Part-C

*Answer **four** questions. Each question carries **ten** marks.*

23a. Derive Born-Lande equation to compute lattice energy.   (6)

   b. How is a more accurate measure of lattice energy calculated than that obtained from Born-Lande equation?   (2)

   c. Mention the Yatsimirshii method of estimating the radii of polyatomic ions. (2)

24a. What is overlap integral? Mention its significance.   (2)

   b. Construct the qualitative MO energy level diagram of BeH_2. Explain how is this MO energy level diagram different from that of other heterodiatomic molecules?   (8)

25a. Explain the Band theory of metals and account for the metallic properties.   (6)

   b. Give an account of impurity and defect semiconductors.   (4)

26a. Explain the behavior of acids, bases, and neutral species in sulfuric acid medium.   (6)

   b. Give an account of the classification of acids and bases?   (4)

27a. What are ionic liquids?Highlight the advantages of ionic liquids in synthesis compared to the conventional solvents.   (6)

   b. What are aprotic solvents? Describe reactions of cations and acidic centers in these solvents.   (4)

28a. What are inclusion compounds? How are they classified?   (4)

   b. Explain their structural features.   (6)

****