



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - CHEMISTRY

FIRST SEMESTER – APRIL 2013

CH 1807/1813 - CONCEPTS IN INORGANIC CHEMISTRY

Date : 30/04/2013

Dept. No.

Max. : 100 Marks

Time : 9:00 - 12:00

Part-A

Answer all questions. Each question carries two marks.

10 X 2 = 20

- Both Cu(I) and Cu(II) are stable, whereas Ca(I) is unstable and is readily oxidized to Ca(II). Explain.
- What are thermochemical radii? How are they computed?
- What is Madelung constant? How is it calculated for rock salt structure?
- Both trigonal bipyramidal and square pyramidal geometries involve dsp^3 hybridization. What is the difference between these two?
- KI with a small enthalpy of hydration (-611 kJ mol^{-1}) is soluble in water, but CaF_2 with a large enthalpy of hydration ($-6782 \text{ kJ mol}^{-1}$) is insoluble in water. Offer a reasonable explanation.
- Give Cady-Else theory of acids and bases.
- Why are ionic liquids called *designer solvents*?
- Define donor and acceptor number of solvents.
- Trimethylammonium hydroxide is a weaker base than tetramethylammonium hydroxide. Why?
- The boiling points of the hydrogen halides follow the trend: $\text{HF} (20^\circ\text{C}) > \text{HCl} (-85^\circ\text{C}) < \text{HBr} (-67^\circ\text{C}) < \text{HI} (-36^\circ\text{C})$: justify the trend.

Part-B

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

8 X 5 = 40

- Derive Born-Landé equation to compute lattice energy.
- Explain the efficiency of packing of ions in crystal lattice and the structure of ionic lattices with unit cell diagrams.
- What is critical radius ratio? Mention its significance. Calculate the size of an octahedral hole in a lattice of closest packed anions.
- What is the principle of conservation of atomic orbitals? Account for the electronegativity difference between atoms in a molecule with the aid of qualitative MO energy level diagram.
- Explain the influence of bond pair and lone pair electrons in determining the structures of SF_4 and NH_3 .
- Give an account of imperfection in crystal lattices.
- Illustrate Bent's rule with examples.
- Explain the solubility of ionic compounds in polar solvents.
- Give an account of the covalent character in ionic compounds in the light of Fajan's empirical rules.
- Write note on (a) proton sponges and (b) symbiosis.
- 21a. Water exerts leveling effect on perchloric acid and hydrochloric acid, whereas acetic acid differentiates these two acids. Explain.
b. What are Lux-Flood acids and bases?
22. Write a note on the crystal structure of ice.

Part-C

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

4 X 10 = 40

- 23a. Schematically represent σ - and π -molecular orbitals formed by the overlap of p -orbitals.
- b. The ionization energy of NO is 894 kJ mol^{-1} and the nitrosyl ion (NO^+) is stabilized and exists in several compounds. Explain with the help of a qualitative MO energy level diagram.
- 24a. What are electron density contour diagrams? How is the effect of polarization illustrated with the aid of such diagrams?
- b. How does hybridization affect electronegativity of atoms in molecules? Illustrate with an example.
- 25a. Explain the Band theory of metals and account for the metallic properties.
- b. Give an account of impurity and defect semiconductors.
- 26a. What are inclusion compounds? How are they classified?
- b. Explain the structural features of zeolites. Describe their application.
- 27a. Explain HSAB theory of acids and bases.
- b. Explain the classification of nonaqueous solvents.
- 28a. Give an account of the solvent properties of molten salts and reactions in such media.
- b. Explain the salient features of ionic liquids as solvents and highlight their importance for chemical reactions.
