Registration Number:

Date & session:

ST JOSEPH'S UNIVERSITY, BENGALURU-27
M.Sc. (CHEMISTRY) – I SEMESTER
SEMESTER EXAMINATION: OCTOBER 2023
(Examination conducted in November /December 2023)

CH 7122 – INORGANIC CHEMISTRY - I
(For current batch students only)

Time: 2 Hours **Max Marks: 50**

This paper contains TWO printed pages and THREE parts.

PART-A

Answer any EIGHT of the following questions. **[8 x 2 = 16]**

1. What are the expected changes in bond order and bond distance that accompany the following ionization processes? (i) $O_2 \rightarrow O_2^+ + e^-$ (ii) $N_2 + e^- \rightarrow N_2^-$
2. Use the concept in valence bond theory to explain why PF_5 is a stable molecule, while NF_5 is not.
3. Sketch the projection representation of unit cell of CsCl.
4. Write the Kapustinskii equation and explain the terms.
5. What is Frenkel defect? Cite an example.
6. What are graphite intercalation compounds? Give an example.
7. Give the classification of phosphazenes with an example each.
8. Arrange the following in the increasing order of basic strength. Give reason.
   (i) NH_3 (ii) NMe_3 (iii) NF_3
9. Calculate the enthalpy of formation of the adduct BF_3-NH_3.
   The given parameters are in $kJmol^{-1}$: For BF_3, E_a=2.00, C_a=1.69 and R_a=0.91.
   For NH_3, E_b=0.69, C_b=2.71 and T_b=11.59.
10. Why does a strong inorganic acid like HNO_3 act as a base in non-aqueous solvent HF? Give the equation for this reaction.

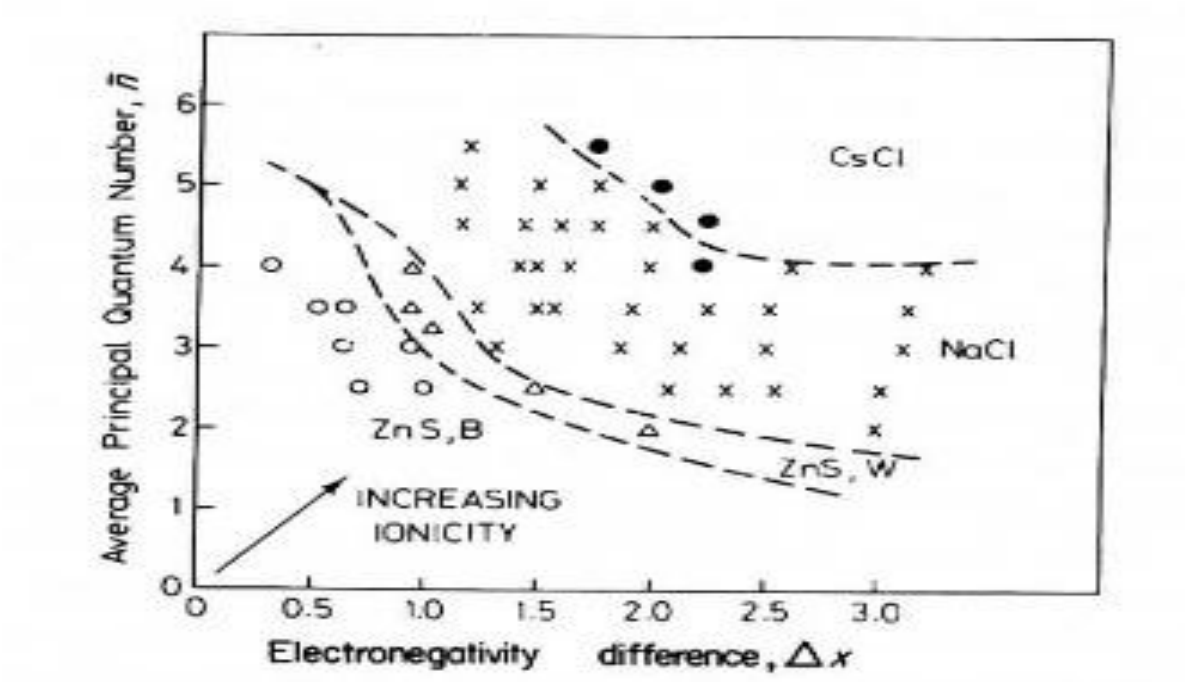
PART-B

Answer any TWO of the following questions. **[2 x 12 = 24]**

11. a) Describe the bonding in ICl (iodine chloride) using a suitable molecular orbital energy level diagram. Give its molecular electron configuration and magnetic property.
    b) Why does CsF react with LiI to give CsI and LiF?
    c) What are supercritical fluids (SCF)? Mention any two properties of SCF. (6+3+3)

12. a) How are higher boranes prepared by pyrolysis method?
    b) White phosphorus catches fire spontaneously in air while red phosphorus does not. Explain based on their structures.
    c) Calculate 'α' and 'β' for B_5H_9. Obtain its STYX number.
    d) Compare the structure and bonding in benzene and borazine. (3+3+3+3)

13. a) Describe non-close packed structures in metals.
    b) Give three criteria for the formation of substitutional solid solutions.
    c) (i) Predict the type of crystal structure that should be expected for magnesium sulfide, MgS, using the structural map given below.
    (ii) What is the coordination number of Mg in MgS?
    Atomic number: Mg = 12, S = 16; Electronegativity values: Mg = 1.3, S = 2.6.



    d) Estimate the lattice enthalpy of sodium chloride.
    Given: A = 1.748, and d = r(Na^+) + r(Cl^-)= 283 pm. (3+3+3+3)

PART-C

Answer any TWO of the following questions. [2 x 5 = 10]

14. a) The length of the side of the sodium chloride unit cell is 566 pm. (3+2)
    Calculate the density of sodium chloride in g/cm^{-3}.
    Atomic mass: Na = 22.99 amu, Cl = 35.45 amu. Avogadro number = $6.023 \times 10^{23} mol^{-1}$.
    b) Predict the value of atomic radius of potassium if its metallic radius is 235 pm.

15. A carborane is obtained when two B-H units of B_6H_{10} are replaced by isoelectronic carbon atoms. (i) Arrive at its molecular formula and (ii) draw the structure.

16. a) Complete the following reactions.
    Identify the acid in the reactants of each of the reactions. Give reasons.
    (i) $MgO + SiO_2 \rightarrow$
    (ii) $Cu^{2+}_{(aq)} + 4\ NH_3 \rightarrow$
    (iii) $NH_4^+ + S^{2-} \rightarrow$
    b) Predict the structure of SOF_4. Justify your answer. (3+2)