Registration Number:

Date & session:

ST.JOSEPH'S UNIVERSITY, BENGALURU -27
M.Sc. (CHEMISTRY) – I SEMESTER
SEMESTER EXAMINATION: OCTOBER 2022
(Examination conducted in December 2022)

CH 7121 – INORGANIC CHEMISTRY - I

Time: 2 hours **Max Marks: 50**

This paper contains TWO printed pages and THREE parts.
All parts of the question paper are compulsory.

PART-A

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

1. Write the expression for the Kapustinskii equation and explain the terms.
2. Draw the orbital overlap diagram for the N_2 molecule according to valence bond theory.
3. What is a **δ** (delta) bond? Give an example of a compound containing delta bond.
4. Mention two types of non-close packed structures in metals and cite an example for each.
5. The empirical atomic radius of sodium is 185 pm and its relative radius is given to be 0.97. What is the metallic radius for sodium after Goldschmidt correction?
6. Give two applications of molten salts.
7. What is Graham's salt? Draw the structure of cyclotriphosphate.
8. Mention two properties of supercritical fluids.
9. How does steric effect influence the acid-base strength?
10. Complete the following reactions.

a) $(NPCl_2)_3 + 6NaOR \longrightarrow$

b) $(NPCl_2)_3 \xrightarrow{230\ ^\circ C}$

PART-B

Answer any **TWO** of the following questions. Each question carries **12** marks. [2x12 = 24]

11. (a) Explain the bonding in SF_6 using valence bond theory.
(b) Draw a suitable molecular orbital energy level diagram for CO. Give its molecular electron configuration.
(c) What is the significance of Drago-Wayland equation?
Calculate the enthalpy of formation for the adduct $H_3N \longrightarrow B(OCH_3)_3$.
For $B(OCH_3)_3$, E = 0.54 and C = 1.22
For NH_3, E = 2.31 and C = 2.04
(d) How is S_2N_2 prepared? (3+3+3+3)

12. (a) Draw and explain two types of holes formed in close packed structures.
(b) Write three criteria for the formation of substitutional solid solutions.
(c) Mention any three types of ternary phases observed in ionic solids and mention their general formulae.
(d) (i) The calculated lattice energy value of AgCl varies significantly from the experimental value. Give reason?
(ii) Which of the following has higher decomposition temperature? calcium carbonate or strontium carbonate. Explain with reasons. (3+3+3+3)

13. (a) Draw the geometric and Lipscomb's semitopological structures of B_4H_{10}.
(b) How are N- and B- substituted borazines prepared? Explain with equations.
(c) What are metallocarboranes? Provide a method of preparation of a metallocarborane from $C_2B_{10}H_{12}$. (4+4+4)

PART-C

Answer any **TWO** of the following questions. Each question carries **5** marks. [2x5 = 10]

14. (a) Write the electronic configuration of the anion in CaC_2 and calculate its bond order.
(b) Arrange the order of C-N bond strength in ascending order for the following, CH_3NH_2(methyl amine), HNCO(isocyanic acid), NaOCN(sodium cyanate). Justify the answer. (3+2)

15. (a) Identify the weak acid with (i) highest acid strength (ii) lowest acid strength from the following. Give reason.
CH_3COOH, FCH_2COOH, $ClCH_2COOH$
(b) Based on radius-ratio rule, predict the binary structure types of (i) PuO_2 (ii) FrI. Ionic radii of Pu^{4+} = 86 pm, O^{2-} = 140 pm, Fr^{+} = 196 pm, I^{-} = 220 pm respectively. (3+2)

16. a) Starting from closo B_6H_8, obtain the molecular formula of the corresponding nido and arachno boranes by successively removing one boron atom each.
b) Deduce the number of 2-centre-2-electron bonds and 3-centre-2-electron bonds in B_5H_{11}. (3+2)
