

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27

M.Sc. CHEMISTRY: I SEMESTER

SEMESTER EXAMINATION: OCTOBER 2018

CH-7118 : INORGANIC CHEMISTRY

Note : (i) The question paper has **two printed pages** and **three parts**. All parts are compulsory.

(ii) Answer any **SIX** out of eight questions from part – A, Any **FOUR** out of six questions from part – B, and any **two** out of three questions from part – C.

Time : 2 ½ hrs

Max .Marks : 70

PART A

1. Write the Lewis structures of ClO_2^- . Using the Formal charge calculation, identify the best possible structure.
2. Using VSEPR theory, predict the shapes of the following molecules: (a) BrF_3 (b) XeF_4 .
3. Use molecular orbital diagram to determine the number of unpaired electrons in O_2^- .
4. What are quadruple bonds? Give an example.
5. How are higher boranes prepared by Stock's method?
6. Give four resonance forms of S_2N_2 .
7. Differentiate between pyrosilicate and cyclic silicate. Give one example each.
8. Draw the structures of $(\text{NPCl}_2)_3$ and $(\text{NPCl}_2)_4$

PART B

4 x 12 = 48

9. (a) Draw the molecular orbital energy diagram for CO.
(b) Draw the molecular orbital energy diagram of SF_6 .
(c) Calculate the density of gold, with a cubic close-packed array of atoms of molar mass M 196.97 g mol⁻¹ and a cubic lattice parameter a 409 pm.
(d) (i) Write a note on F centres.
(ii) Explain why WO_3 is 'n' type semiconductor whereas MgO is an insulator.
(4 x 3 = 12)
10. (a) Draw the Ketallar triangle and predict the type of bonding dominating in the metal oxides AO & BO. The electronegativities of A, B and O are 1.31, 1.90 and 3.44 respectively.
(b) Draw the unit cell structure of zinc blende and explain the important features. Give its projection representation.
(a) Using Kapustinskii equation, estimate the lattice enthalpy of potassium nitrate, KNO_3 . Given, the sum of their thermochemical radii of the cation and anion are 138 pm 189 pm respectively; $d^* = 34.5$ pm, $\kappa = 1.21 \times 10^5$ kJ pm mol⁻¹.
11. a) Give one structural difference each for four different allotropes of carbon.
b) Draw geometrical and Lipscomb's semitopological structures for $\text{B}_{10}\text{H}_{14}$ and write its styx number.
c) What are carboranes? Starting from B_6H_{10} arrive at the structure of $\text{C}_4\text{B}_2\text{H}_6$.

(3 x 4 = 12)

12. a) Discuss the structure of Borazine. Give one chemical reaction to show the difference between inorganic benzene and organic benzene.
 b) Give structures of I_2Cl_6 and I_5^- .
 c) Discuss two factors affecting the strength of Lewis and Bronsted acid- base strength.
 (3 x 4 =12)
13. a) Give one reaction each in supercritical fluids and molten salts.
 b) What are ionic liquids? Give a method of preparation of ionic liquids and give one application.
 c) What are metallocarboranes? Give an example.
 d) How is boron nitride prepared? Give two applications of it.
 (3 x 4 = 12)

PART C

2 X 5 = 10

14. The enthalpy change and entropy change for the decomposition reaction of two alkaline earth metal carbonates A & B are given in the table. Calculate the decomposition temperature of A and B. Which metal carbonate between A and B has the metal atom with lower atomic mass ? Justify your answer.

Thermodynamic data	A	B
ΔH	234.6 kJ mol ⁻¹	269.3 kJ mol ⁻¹
ΔS	171 J mol ⁻¹	172 J mol ⁻¹

15. a) An alloy of gold is prepared in which the gold occupies all corners of the cube and copper occupies all faces. Calculate the mass percentage of gold in the alloy. The atomic mass of gold and copper are 197 and 64 amu respectively.
 b) A neutral borane has eight, 2-center-2- electron bonds and six 3- center-2- electron bonds. How many hydrogen atoms are there in the borane?
16. For each cation from 'A' identify the most suitable ligand from 'B' which form stable compound. Give reason.

A	B
Li ⁺	CN ⁻
Cs ⁺	S ²⁻
Cu ⁺	F ⁻
Cd ²⁺	I ⁻