M.Sc. - Chemistry

I Semester End Examination - May 2022
Inorganic chemistry-I

Course Code: MCH101T **QP Code: 11007**
Time: 3 hours **Total Marks: 70**

Instruction: Answer Question No. **1** and any **FIVE** of the remaining.

1. Answer any ***TEN*** questions **(2×10 =20)**

a) In PCl_3F_2, F occupies axial position whereas Cl is equatorially situated. Give reason.

b) What is agostic bond? Mention its features with example.

c) $AlCl_3$ behaves as Ionic molecule in polar medium but covalent in free medium. Justify

d) How heteropoly acids are classified?

e) Borazine readily undergo addition reaction with HCl, whereas benzene does not why?

f) Outline the bonding in diborane

g) What is symbiosis? Give an example

h) How do BrF_3 auto-inonize? How do SbF_3 and KF act in BrF_3?

i) Depict the structure of metal clusters, $Os_5C(CO)_{15}$ and $[Fe_4N(CO)_{16}]^-$

j) Enumerate factors influencing nuclear stability

k) Using shell model of the nucleus find out the spin and parity of $^{13}C_6$ and $^{33}S_{16}$ Nuclides.

l) What are nanoclusters?

2. a) Construct the MO diagram for CO and explain their bond order and magnetic properties.

b) Identify the number of lone pair of electrons present in the following ClF_3, I_3^-, XeF_6, ReF_7, Predict their structures.

c) In the following set of compounds, indicate the compound that shows greater degree of Ionic character with proper reasoning

i) AgCl and KCl

ii) NaI and NaCl

iii) $SnCl_2$ and $SnCl_4$ **(3+4+3=10)**

3. a) Draw the topological structure and give the STYX code of B_4H_{10} and B_5H_{11}

b) Write briefly on the synthesis and uses of ZSM-5

c) How is $(PNCl_2)_3$ is synthesized? Explain the bonding in it. **(4+3+3=10)**

4. a) Distinguish between LNCC'S and HNCC's. Write the structure of $[Re_2Cl_8]^{2-}$ and explain the bonding in it.

b) How Isopoly molybdates forms from MoO_4^{2-} ? Write the equations

c) Write the chemical reactions of BrF_3 and N_2O_4 **(4+3+3=10)**

5. a) Discuss the salient features of shell model of the nucleus

b) Distinguish between secular and transient equilibria. Give the graphical representation for both with an example each.

c) Write a note on Auger effect **(3+4+3=10)**

6. a) Explain Fajan's rules. Based on it explain why AgCl shows lower melting point than KCl.

b) Explain the Crystal Structure of TiO_2 and CaF_2

c) What are pyroxenes and amphiboles? Give an example for each. **(3+4+3=10)**

7. a) What are radius ration rules? Derive the limiting radius ratio of tetrahedral geometry

b) What are carboranes? How are they classified? Give one examples for each type

c) Write a note on synthesis of nanomaterials by sol gel method **(3+4+3=10)**

8. a) Explain HSAB concept. Based on it explain why $[Co(CN)_5I]^{3-}$ and $[Co(NH_3)_5F]^{2+}$ are stable while $[Co(CN)_5F]^{3-}$ and $[Co(NH_3)_5I]^{2+}$ are unstable.

b) Discuss the synthesis and structure of S_4N_4

c) Write a note on Zintl ions **(3+4+3=10)**

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