I Semester M.Sc. Examination, January 2017
(CBCS)
CHEMISTRY
C – 101 : Inorganic Chemistry – I

Time : 3 Hours   Max. Marks : 70

Instruction : *Answer question No.* **1** *and* **any five** *of the remaining questions.*

Answer **any ten** of the following.   **(10×2=20)**

1. a) What is agostic bonding ? Explain with an example.

   b) In PCl_3F_2, F occupies axial position whereas Cl is equitorially situated. Give reason.

   c) Draw the unit cell structure of NaCl and indicate the coordination number of each ion.

   d) Why is borazine called inorganic benzene ?

   e) Outline the reaction of diborane with NH_3 and Me_3N.

   f) Write any two structural differences between pyroxene and amphibole.

   g) Give an example each of acid base reaction and solvolytic reaction that take place in CH_3COOH.

   h) What is Faraday effect ?

   i) Why metals like Pd^{2+}, Ag^+ occur as sulphides in nature whereas Mg^{2+} and Ca^{2+} are not ?

   j) Give the total valence electron counts for $OS_3(CO)_{12}$ and $Ir_4(CO)_{12}$ and predict the number of M-M bonds present in them.

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

   l) Enumerate the factors influencing nuclear stability.

2. a) In the following set of compounds, indicate the compound that shows greater degree of ionic character with proper reasoning.

   i) $SnCl_2$ and $SnCl_4$

   ii) NaCl and KCl

   iii) AgCl and AgI.

   b) Give the postulates of VSEPR theory. Based on it, predict the structures of the following :

   i) ICl_4^-

   ii) TeF_5^-

   iii) ReF_7.

   c) What are radius ratio rules ? Derive the limiting radius ratio of an ionic solid with octahedral geometry. **(3+4+3=10)**

3. a) Derive Born Lande's equation for an ionic solid.

   b) How is $(PNCl_2)_3$ synthesised ? Explain the bonding in it.

   c) What are carboranes ? How are they classified ? Give one example for each type. **(4+3+3=10)**

4. a) How are σ, π and δ orbitals formed ? Construct the MO energy level diagram of HF molecule and explain its salient features.

   b) How are feldspars and ultramarines formed ? Why are orthoclase feldspars are more symmetrical than plagioclase feldspars ?

   c) Explain the structure of zeolite A. Describe its molecular sieving property. **(4+3+3=10)**

5. a) Explain the structures of the following silicates :

   i) Kaolinite

   ii) Talc

   iii) Beryl

   iv) Muscovite mica.

   b) How are B_4H_{10} and B_2H_6 synthesized ? Derive their styx code and write their structures.

   c) How are isopolymolybdates formed from MoO_4^{2-} ? Write the equations. **(4+3+3=10)**

6. a) Enumerate the applications of isopoly and heteropoly anions.

   b) Explain HSAB concept. Based on it :
      i) Explain why $[Co(CN)_5F]^{3-}$ and $[Co(NH_3)_5I]^{2+}$ are unstable whereas $[Co(CN)_5I]^{3-}$ and $[Co(NH_3)_5F]^{2+}$ are stable.
      ii) Classify the following as hard, soft and border line acids and bases ;
      Na^+, Ca^{2+}, OH^- and H^+.

   c) Define optical activity. Draw the structures of the stereoisomers for the following complexes and indicate the isomers which show optical activity.
      i) $[Co(en)_2Cl_2]^+$
      ii) $IrCl_2(PPh_3)_2(CO)(CH_3)$. **(4+3+3=10)**

7. a) What is Cotton effect ? Write briefly on the determination of absolute configuration of metal complexes by CD with suitable examples.

   b) Enumerate the factors that favour M – M bond. Draw the structures of $[Mo_6Cl_8]^{4-}$ and $[Re_3Cl_{12}]^{2-}$.

   c) What are Wade-Mingos and Lauher rules ? Using these rules, predict the structures of the metal carbonyl clusters $[Fe_4(CO)_{12}C]^{2-}$ and $[Os_5(CO)_{15}]^{2-}$.
   (4+3+3=10)

8. a) Discuss the salient features of liquid drop model of the nucleus.

   b) How does tunneling effect ? Explain the α-decay process ?

   c) Distinguish between transient and secular equilibria. Give the graphical representation for both with an example each. **(3+3+4=10)**

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