



I Semester M.Sc. Degree Examination, January/February 2018

(CBCS Scheme)

CHEMISTRY

C - 101 : Inorganic Chemistry - I

Time : 3 Hours

Max. Marks : 70

*Instruction : Answer question no. 1 and any five of the following.*

1. Answer any ten of the following.

(10×2=20)

- State the Bent's rule with an example.
- The radii of  $Mg^{2+}$  and  $S^{2-}$  are 0.66 and 1.84 Å respectively. Predict the most probable crystal structure of MgS.
- LiCl is soluble in alcohol, while all other alkali metal chlorides are insoluble. Why?
- Draw the structures and identify the charge on the silicate ions  $[Si_2O_7]^{4-}$  and  $[Si_3O_9]^{6-}$ .
- How are nido and arachno structures related to close structures?
- Borazine is more reactive than benzene towards addition of HX. Give reasons.
- What is symbiosis? Give an example.
- What is Cotton effect?
- How does  $BrF_3$  autoionize? How do  $SbF_5$  and KF act in  $BrF_3$ ?
- Depict the structures of carbonyl clusters,  $Co_4(CO)_{12}$  and  $Fe_3(CO)_{12}$ .
- Define the terms : isotopes, isobars, isotones and isomers.
- Calculate the binding energy per nucleon for  $^{59}_{27}Co$  with a mass of 58.95182 amu. (Mass of H-atom = 1.008142 amu and neutron is 1.008982 amu).



2. a) Discuss the postulates of Fajan's rules.  
 b) Explain the structures of  $I_3^-$  and  $ICl_2^-$  on the basis of VSEPR concept.  
 c) Draw MO energy level diagram for CO molecule. List out the salient features of it. (3+3+4=10)
3. a) Boranes have the following formula :  $B_4H_{10}$ ,  $B_5H_9$  and  $B_2H_6$ . Name the boranes and calculate their styx code.  
 b) Write briefly on the use of ZSM-5 in the conversion of methanol to gasoline.  
 c) Outline the preparation, structure and bonding in  $P_3N_3Cl_6^-$ . (3+3+4=10)
4. a) Write different chemical reactions involved in anhydrous  $H_2SO_4$ .  
 b) Explain HSAB concept. Based on it predict which ion is more stable  $AgF_2^-$  or  $AgI_2^-$ .  
 c) Describe the utility of CD in determining the absolute configuration of metal complexes. (3+3+4=10)
5. a) Depict the nuclear binding energy curve and explain its salient features.  
 b) Which one of  $^{208}_{82}Pb$ ,  $^{207}_{82}Pb$  and  $^{206}_{82}Pb$  is the most stablest nuclide ? Justify your choice.  
 c) On the basis of electron counts, classify the following carboranes into closo, nido and arachno types. Justify your choice. 1, 3- $C_2B_7H_{13}$ ,  $C_2B_4H_6$ ,  $C_2B_8H_{12}$  and  $C_2B_{10}H_{12}$ . (3+3+4=10)
6. a) What are Zintl ions ? Depict the structures of  $Pb_6^{2-}$  and  $Sn_9^{4-}$ .  
 b) Calculate limiting radius ratio for tetrahedral arrangement.  
 c) What are pyroxenes and amphiboles ? Give an example for each. Draw their structures. (3+3+4=10)
7. a) Write a comprehensive note on magnetic circular dichroism.  
 b) Explain the salient features of Fermi gas model.  
 c) The activity of 4.0 MBq source of  $^{24}Na$  becomes 0.051 mc after 2.5 d. Calculate the decay constant of  $^{24}Na$ . (3+3+4=10)
8. a) Define lattice energy and derive Born-Landé's equation.  
 b) Explain the structure and bonding involved in a dinuclear  $[Re_2Cl_8]^{2-}$ .  
 c) Discuss briefly on the applications of heteropoly acids of tungsten and molybdenum. (4+3+3=10)