



I Semester M.Sc. Examination, January 2015  
(CBCS Scheme)  
Chemistry  
C – 101 : INORGANIC CHEMISTRY – I

Time : 3 Hours

Max. Marks : 70

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

1. Answer **any ten** of the following. **(2×10=20)**
- Four elements arbitrarily labelled A, B, C and D have electronegativities 3.8, 3.3, 2.8 and 1.3 respectively. Place the compounds AB, AD, BD and AC in order of increasing covalent character.
  - What is agostic bond ? Mention its features with examples.
  - Sketch the Perovskite structure and explain its features.
  - Borezine, which is known as inorganic benzene readily undergoes addition reaction with HCl, whereas benzene does not undergo this reaction. Why ?
  - How is orthocarborane synthesized ? What are its properties ?
  - How do muscovite and margarite minerals differ from pyrophyllite ?
  - What is symbiotic effect ? Explain with an example.
  - Which are the four important isopolyanion species of molybdenum ? Under what pH conditions they exist as stable species.
  - What are-Wade-Mingos and Lauher rules ? Using these rules, predict the structure of a metal carbonyl cluster  $[\text{Fe}_4(\text{CO})_{12}\text{C}]^{2-}$ .
  - Calculate the binding energy per nucleon for  $^{20}\text{Ne}$  nucleide, whose mass is equal to 19.992440 amu. (Given :  $m_{\text{H}} = 1.007825$  amu and  $m_{\text{n}} = 1.008665$  amu).
  - What is Auger effect ? Explain.
  - Write the significance of the term n/p ratio.



2. a) State the rules of VSEPR theory. Based on this model, predict the shapes of the following molecules and write their structure. **(5+5=10)**
- $\text{ICl}_4^-$
  - $\text{TeF}_5^-$  and
  - $\text{TaF}_8^{3-}$
- b) What is Lattice energy of an ionic solid ? Derive the Born-Landé equation for an ionic solid.
3. a) How are trimeric and tetrameric cyclophosphazenes obtained ? Discuss the bonding interactions and structural features of the trimer. **(5+5=10)**
- b) Describe the classification of Silicates. Sketch and explain the structure of one silicate in each case.
4. a) Explain the factors that might affect the strength of hard-hard and soft-soft interactions ? Classify the following into hard acid, hard base, soft acid and soft base ;  $\text{PO}_4^{3-}$ ,  $\text{GaCl}_3$ ,  $\text{AlCl}_3$  and  $\text{P}(\text{OR})_3$ . **(5+5=10)**
- b) What are isopoly and heteropoly acids ? Discuss their structures with examples.
5. a) What are the experimental evidences for the shell model of the nucleus ? Give its salient features and predict the nuclear spin and parity of  $^{33}_{16}\text{S}$  and  $^{43}_{20}\text{Ca}$  nucleides using this model. **(5+5=10)**
- b) Distinguish between secular and transient equilibria. Derive a general expression for the growth of a daughter nucleus, B in the sequence;  

$$A \xrightarrow{\lambda_1} B \xrightarrow{\lambda_2} C \text{ where } \lambda_1 \ll \lambda_2.$$
6. a) How are the molecular orbitals of heteronuclear diatomic molecules different from homonuclear diatomic molecules ? Draw the MO diagram of NO molecule and comment on the bond order and magnetic properties of NO,  $\text{NO}^+$  and  $\text{NO}^-$  species. **(4+3+3=10)**
- b) Point out the significance of radius ratio rules and obtain the lower limiting radius ratio for an ionic solid having NaCl structure.
- c) What is multicenter bonding ? Explain with an example.



7. a) What are carboranes ? Give an account of their classification. **(4+3+3=10)**  
b) Explain the acid-base concept in non-aqueous media with suitable examples.  
c) How are sodalite and ZSM – 5 synthesized ? Why is ZSM – 5 considered as an efficient performance catalyst ?
8. a) Discuss the utility of ORD and CD curves for the determination of absolute configuration of metal complexes. **(4+3+3=10)**  
b) How does tunneling account for the emission of  $\alpha$  - particles ?  
c) Distinguish between LNCC's and HNCC's. Give one example in each case and write their structures.

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