I Semester M.Sc. Degree Examination, Jan./Feb. 2014
(2010-11 Scheme) (NS)
CHEMISTRY
C – 101 : Inorganic Chemistry – I

Time : 3 Hours   Max. Marks : 80

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

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

   a) Explain Bent's rule.

   b) How are $\sigma-$, $\Pi-$ and $\delta-$ molecular orbitals formed ?

   c) The electronegativities of A, B, C and D are 3.8, 3.3, 2.8 and 1.3 respectively. Place the compounds AB, AD, BD and AC in order of increasing covalent character.

   d) Explain why Li^+ has higher hydration energy than that of K^+.

   e) What is synergic bond ? Explain with an example.

   f) How is S_4N_4 obtained ? Draw its structure.

   g) What are molecular sieves ? Give the composition of ZSM-5.

   h) Explain the term super acids with an example.

   i) Give the significance of the term 'n/p ratio'.

   j) A borane has a *styx* code 4120. Name the borane and draw its structure.

   k) What are Lewis acids and bases ? Explain with examples.

   l) With respect to sulfur, explain the term polymorphism.

2. a) What is meant by partial ionic character of covalent bonds ? How is this related to electronegativity ?

   b) Outline the concept of VSEPR model. Based on it, discuss the shapes of ClF_3, SF_4 and BrF_5.

   c) Draw the resonance structures for $O\overline{C}N$ and $CN\overline{O}$ and assign formal charges.

                                                                    (4+4+4=12)

3. a) Explain why crystals of ionic compounds are relatively hard and brittle.

   b) Using Slater's rule, calculate the effective nuclear charge experienced by one of the d-electrons in vanadium.

   c) Depict a Walsh diagram for AH_2 molecule and based on it explain the shape of water molecule.
   $$(4+4+4=12)$$

4. a) How are trimeric and tetrameric cyclophosphazenes prepared ? Write the structure of the trimer and explain its bonding.

   b) Discuss the structure and bonding in borazine.

   c) Explain the leveling effect of solvents.
   $$(5+4+3=12)$$

5. a) Describe critically the preparation, properties and structure of heteropoly acids of molybdenum.

   b) Give the classification of condensed phosphates and mention their characteristics.

   c) Write a short note on shell model.
   $$(5+4+3=12)$$

6. a) How does N_2O_4 auto-ionize ? Discuss its role in preparing anhydrous metal nitrates.

   b) Discuss the classification and structures of silicates.

   c) Explain Wade's rules and their use in the classification of boranes and carboranes.
   $$(3+5+4=12)$$

7. a) Based on HSAB concept, explain the following :
   Will Cu^{2+} react more strongly with HO^- or NH_3 ? With O^{2-} or S^{2-} ?

   b) Write briefly on the reactions studied in bromine trifluoride solvent.

   c) Give a comprehensive note on liquid drop model of nucleus.
   $$(4+4+4=12)$$

———————————

I Semester M.Sc. Degree Examination, Jan./Feb. 2014
(2010-2011 Scheme) (NS)
CHEMISTRY
C – 103 : Physical Chemistry – I

Time : 3 Hours

Max. Marks : 80

Instruction : *Answer question 1 and* **any five** *of the* **remaining.**

1. Answer **any ten** of the following :

(2×10=20)

a) State and explain Heisenberg uncertainty principle.

b) Find out deBroglie wave length for a beam of electrons whose kinetic energy is 100 ev. (Given m = 9.1×10^{-28}g).

c) What is J-J coupling ?

d) Distinguish between a wave function and an eigen function with examples.

e) Why the approximations are necessary in quantum mechanics ?

f) Calculate the effective nuclear charge for 25 and 26 electrons of nitrogen using Slater's rules.

g) Distinguish between macroscopic and microscopic kinetics.

h) Write the reaction mechanism for pyrolysis of acetaldehyde.

i) How do you account for the fact that an enzyme reaction has an optimum pH at which its activity is maximum ?

j) What are the limitations of Lindemann theory of unimolecular reactions ?

k) Give the Laplace equation and explain the terms involved in it.

l) The rate of a second order reaction is 4.40×10^{-4} dm^3 mol^{-1}s^{-1} at 30°C and 9.20×10^{-4} dm^3 mol^{-1} s^{-1} at 40°C. Calculate the activation energy of the reaction.

2. a) Formulate the time-independent Schrodinger equation.

b) Pointout the concept of operators. Write the Hamiltonian operator for normal He atom and explain each term.

c) Solve the Schrodinger equation for the particle in a ring.

(4+4+4=12)

3. a) Write the Schrodinger equation for hydrogen atom in spherical polar coordinates and separate it into R, ϕ and θ equations.

   b) What are the quantum numbers ? How many quantum numbers has an electron in the atom ?

   c) State the significance of radial and angular distribution functions.   **(5+4+3=12)**

4. a) Apply variation method to obtain the ground state energy for a particle in a one dimensional box.

   b) Outline the HMO method for benzene.

   c) Obtain the expression for the correction in energy of a non-degenerate system according to first-order perturbation theory.   **(4+4+4=12)**

5. a) Derive the relevant rate expression for the first order forward and backward reversible reaction.

   b) Compare collision theory with transition state theory of reaction rates.

   c) Predict, giving reasons the effect of an inert electrolyte concentration on the rate constant of the following reactions.

   i) $CH_2ICOOH + CNS^- \rightarrow$ Products

   ii) $S_2O_8^{2-} + I^- \rightarrow$ Products

   iii) $[CO(NH_3)_5 Br]^{2+} + OH^- \rightarrow$ Products   **(5+4+3=12)**

6. a) Derive the rate expression for the kinetics of photochemical reaction between H_2 and Br_2.

   b) Explain the lock and key mechanism for enzyme catalysed reactions.

   c) Depict Lineweaver-Burk plot using Michaelis-Menten equation and explain how it is useful to determine the value of K_m.   **(5+3+4=12)**

7. a) Outline the relaxation technique for the study of fast reactions.

   b) Derive Gibbs adsorption isotherm equation and write its applications.

   c) Write a brief note on mechanical adsorption.   **(4+5+3=12)**