

DEPARTMENT OF SCIENCES I SEMESTER M.Sc (CHEMISTRY) END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: INORGANIC CHEMISTRY I [CHM 601]

REVISED CREDIT SYSTEM

Time: 3 Hours

Date: 23.11.2016

MAX. MARKS: 50

Instructions to Candidates:

- Answer ANY FIVE FULL questions.
- Draw diagrams and write equations wherever necessary.
- **1.** A. i) Discuss the physical significance of ψ and ψ^2 . Describe the formation of molecular orbitals by the linear combination of atomic orbitals using wave mechanics.
 - ii) Sketch and explain the special features of the following; a) Cesium chloride structure
 - **b**) HCP structure in metals.
 - iii) Discuss the geometry of the following isoelectronic species based on VSEPRT;

CH₄, NH₃, H₂O, and HF.

- **B**. Comment upon and explain the following observations;
- a) Table salt and table sugar both dissolve in water. b) It is possible to write on paper with

graphite but not with diamond. c) Ice is less dense than water at zero degree Celsius.

d) Acetic acid forms dimer and solid argon exist.

(6+4)

2. A. i) Describe each of the following; a) Information given by bond order b) Organic precipitating agents

ii) Explain the following; a) O_2^+ is more stable than O_2 while N_2^+ is less

stable than N_2 **b**) CN^- has shorter bond distance than CN while O_2^- has longer bond distance than O_2

B i) Justify the following statements; a) But for the existence of hydrogen bonding the present life on earth would not have existed. b) The three isomeric dichlorobenzenes can be identified by their dipole moments. (6 + 4)

3. A. i) The gaseous KCl has a measured dipole moment of 10 D. The bond distance is 2.67 x 10⁻⁸ Cm. Calculate the dipole moment of KCl if it were completely ionic.

- **ii**) Describe the two uses of the Born-Haber cycle. Explain the effect of electron configuration of the cation on the covalent character in ionic compounds.
- **iii**) Write the special features of granular and gelatinous precipitates and discuss their suitability in a gravimetric analysis.
- **B.** Give reasons for the following; **a**) Dipole moment of NH₃ is higher than that of NF₃.

b) The structure of CH_4 is tetrahedral while that of NH_3 is pyramidal. **c**) The C-Cl bond is polar but the CCl_4 molecule is non-polar. **d**) The melting points of lithium halides decreases from fluoride to iodide. (6+4)

4. A. i) Write the electron configuration using the MOELD appropriate for s-p mixing and describe the bonding in the C₂ molecule.

ii) Results from four replicate measurements of normality of a solution are 0.2041, 0.2049, 0.2039 and 0.2043. Calculate the mean, median, average deviation, standard deviation, and coefficient of variation.

iii) Give two explanations for the fact that an image in a mirror is a faithful portrayal of the reflected object.

B. i) Account for the following; a) It is not possible to prepare a sodium hydroxide solution whose molarity is known precisely.b) Zig-zag structure is observed in the solid HF.

- ii) Define masking and demasking processes. How can masking and demasking agents can be used to enhance the selectivity of titrations? (6+4)
- 5. A. i) What are hydrides? Explain the special features of covalent and metallic hydrides.
 - ii) Explain the structural characteristics of XeO₂F₂. Write two applications of xenon and argon?iii) What are silicates? Explain the structural futures of chain silicates.

B. i) What are pseudohalides? List two similarities and differences between pseudohalides and halides.

- ii) Give reasons; a) Natural zeolites don't breakdown in mild acidic environment whereas synthetic zeolites do . b) Actinides show higher oxidation states unlike lanthanides. (6+4)
- **6. A. i**) Explain the electronic spectra of lanthanides. How are they different from those of transition metals?

ii) Explain the structure of fullerenes. Mention the applications of C_{60} .

iii) Give two similarities and differences each between lanthanides and actinides.

B. i) Mention any two biological importances of the following metals; a) Na b) K c) Ca d) Mg
ii) What is a breeder nuclear reactor? How is enriched uranium separated from U²³⁸? (6 + 4)

Page 2 of 2