

Birla Institute of Technology and Science, Pilani, Rajasthan 333031
Mid Semester Examination, 2nd Semester, 2017-2018

CHEM G552: Advance Inorganic Chemistry
Time: 90 mins.

(Closed Book)

Max. Marks: 30

Date: 7th March, 2018

Instructions to the students:

1. There are **four questions** in all. Attempt all the questions.
2. Start answering each question on a fresh page. **Answer all parts of a question together.**
3. Write brief answers to the point with proper justifications.

Q.1. (a) In a close packed type crystal structure of CsCl prove that the minimum value of radius ratio (r^+/r^-) should be 0.732. (r^+ = radius of cation and r^- = radius of anion). **[3]**

(b) Calculate the spin only magnetic moment value of B₂ and C₂ molecule. [At. No. of Boron (B) and Carbon (C) are 5 and 6 respectively] **[1.5+1.5]**

(c) Write the molecular geometry and hybridization of AsCl₅, AsCl₃ and ICl₃ molecules. [At. No. of As, Cl and I are 33, 17 and 53 respectively] **[3]**

Q.2. (a) Write the symmetry elements present in [MnCl₄]²⁻ and [Ni(H₂O)₆]²⁺ ions. **[3]**

(b) Write the structure of molecules (one for each) that possess C₁, C_s, C_i, D_{3h}, C_{∞v} and D_{∞h} point groups. **[3]**

(c) Using the given character table, answer the following-

| C_{4v} | E | $2C_4$ | C_2 | $2\sigma_v$ | $2\sigma_d$ | | |
|----------|-----|--------|-------|-------------|-------------|--------------------|------------------|
| A_1 | 1 | 1 | 1 | 1 | 1 | z | $x^2 + y^2, z^2$ |
| A_2 | 1 | 1 | 1 | -1 | -1 | R_z | |
| B_1 | 1 | -1 | 1 | 1 | -1 | | $x^2 - y^2$ |
| B_2 | 1 | -1 | 1 | -1 | 1 | | xy |
| E | 2 | 0 | -2 | 0 | 0 | $(x, y)(R_x, R_y)$ | (xz, yz) |

(i) What is the order of this character table? **[0.5]**

(ii) What is the significance of A, B, and E? **[1.5]**

(iii) What is the significance of subscript 1 and 2? **[1]**

(iv) Which Mulliken symbol represents the IR and Raman active modes? **[1]**

Q.3. (a) Draw the molecular orbital diagram of OF molecule with proper labeling of diagram. Which ionic form of this molecule (cationic or anionic) will be more stable? Justify your answer. [At. No. of Oxygen (O) and Fluorine (F) are 8 and 9 respectively] **[3+1]**

(b) Write the number of crystal system, point group and space group possible in single crystal X-ray diffraction studies? **[1.5]**

(c) Explain inner and outer orbital complex. Which one is relatively more stable? **[1.5]**

Q.4. Write short notes on

(a) VSEPR theory

(b) Schottky defect in ionic crystal

(c) Fajan's Rule

(d) p type semiconductor

[1x4]

*******END*******