

2021
M.Sc.
First Semester
CORE – 01
CHEMISTRY
Course Code: MCHC 1.11
(Inorganic Chemistry - I)

Total Mark: 70

Pass Mark: 28

Time: 3 hours

Answer five questions, taking one from each unit.

UNIT-I

1. (a) Write short notes on the following with one example each: $2\frac{1}{2} \times 2 = 5$
 - (i) Inversion centre
 - (ii) Plane of symmetry
- (b) Define optical activity and dissymmetry. Give two examples of optically active compounds. $2+2=4$
- (c) Write the character table for the point group C_{20} and give the definitions of the symbols attached to it. 5
2. (a) Define point groups and order of a group. Write the symmetry elements and give the point groups of NH_3 and PCl_5 molecule. $2+3=5$
 - (b) Discuss systematically the symmetry elements and operation present in tetrahedral geometry. 5
 - (c) Give the multiplication table of C_{30} point group and mention whether it is an abelian or non-abelian. 4

UNIT-II

3. (a) Draw the molecular orbital diagram for NO and mention the magnetic character. 4
- (b) Explain electronegativity in terms of $3 \times 2 = 6$
 - (i) Pauling
 - (ii) Mulliken

- (c) What are the factors affecting stability of metal complexes? 4
4. (a) Write short notes on 3×2=6
 (i) Chelate effect
 (ii) Polarity bonds
- (b) Draw molecular orbital diagram of O_2^+ and mention the magnetic character. 4
- (c) Explain Walsh diagram 4

UNIT-III

5. (a) Write on paramagnetism and diamagnetism. 2+2=4
 (b) What is diamagnetic correction? Deduce the relation to get corrected value of paramagnetic susceptibility by diamagnetic correction. 2+4=6
 (c) Discuss briefly the quenching of orbital angular momentum in octahedral complexes. 4
6. (a) Write notes on 2×2=4
 (i) Temperature independent paramagnetism
 (ii) Magnetic susceptibility
 (b) Explain determination of magnetic susceptibility using Gouy's method. Give its advantages. 6
 (c) Discuss the variation of magnetic susceptibility with temperature (Curie's law). 4

UNIT-IV

7. (a) Discuss the magnetic properties of Lanthanides. 4
 (b) Calculate the magnetic moment of Pm^{+3} (Atomic no of Pm = 61) 4
 (c) Find out the magnetic character of the following by applying CFT 2×3=6
 (i) $[Fe(CN)_6]^{-4}$
 (ii) $[Fe(H_2O)_6]^{+2}$
 (iii) $[CoF_6]^{-3}$
8. (a) Plot a graph of octahedral and tetrahedral coordination taking their

- CFSE into consideration. 6
- (b) State John Teller distortion. 2
- (c) Which metal ion/ions show John Teller distortion?
 (i) Cu^{+2} (low spin)
 (ii) Fe^{+2} (low spin)
 (iii) Cr^{+2} (high spin)
 If yes, mention if it is strong or weak John Teller distortion. 6

UNIT-V

9. (a) What are Orgel diagram? Draw Orgel diagram for a d^1 metal ion in an octahedral field. 2+3=5
- (b) How many bands are expected in Cr(III) octahedral complex? Mention the bands observed. 2+4=6
- (c) What is nephelauxetic series? 3
10. (a) What are the selection rules? Explain the rule and its relaxation. 2+5=7
- (b) Explain the MOT of complexes in which there is no π -bonding. 4
- (c) What is adjusted crystal field theory? 3