

ASSIGNMENT BOOKLET

**M.Sc. in Chemistry Programme
(MSCCHEM)**

INORGANIC CHEMISTRY 1

Valid from 1st July, 2026 to 30th June, 2027

**It is Compulsory to submit the Assignment before filling in the Term-
End Examination Form.**



**School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2026-27)**

Dear Student,

Please read the Section on assignments in the Programme Guide for M.Sc. in Chemistry that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, which would consist of one tutor-marked assignment for this course. The assignment is in this booklet, and covers all the four blocks of the course. The total marks of all the parts are 100, of which 40% are needed to pass it.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

- 1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ENROLMENT NO.:

NAME:

ADDRESS:
.....
.....

COURSE CODE:

COURSE TITLE:

ASSIGNMENT NO.:

STUDY CENTRE: **DATE:**

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

- 2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
- 4) Your answers should be precise.
- 5) Solve Part (A) and Part (B) of this assignment, and **submit the complete assignment answer sheets within the due date.**
- 6) The assignment answer sheets are to be submitted to your Study Centre within the due date. **Answer sheets received after the due date shall not be accepted.**

We strongly suggest that you retain a copy of your answer sheets.

- 7) This assignment is **valid from 1st July, 2026 to 30th June, 2027**. If you have failed in this assignment or fail to submit it by June, 2027, then you need to get the assignment for the year 2027, and submit it as per the instructions given in the Programme Guide.
- 8) **You cannot fill the examination form for this course** until you have submitted this assignment.

We wish you good luck.

Tutor Marked Assignment

MCH-011: INORGANIC CHEMISTRY 1

Course Code: MCH-011

Assignment Code: MCH-011/TMA/2026-27

Maximum Marks: 100

Note: Attempt all questions. The marks for each question are indicated against it.

1. a) Explain the trends in melting points of alkali, alkaline earth and transition metals of fourth, fifth and sixth periods along with suitable illustration. (5)
b) Give the second postulate of VSEPR theory. Predict the structure of the molecule sulfur tetrafluoride with the help of VSEPR theory. Draw the structure. (5)
2. a) Which ones of the following species will exhibit inorganic aromaticity: (5)
a) $S_3N_3^-$ b) $S_4N_3^+$ c) S_5N_5 ? Justify your answer.
b) With the help of suitable chemical equations explain how the mixed-substituent polymers of phosphazenes are synthesized? (5)
3. a) Give the classification of organotransition metal alkyls and aryls along with suitable examples for each type. (5)
b) With the help of a suitable example explain what fluxional organometallic compounds are. With the help of NMR studies how their presence was confirmed? (5)
4. a) Calculate the Effective Atomic Number (EAN) of the $Mn(CO)_4NO$ complex. Here how is the ligand NO treated as? In this was how the ligand NO becomes analogous to CO and N_2 ? (5)
b) With the help of suitable diagrams, explain the synergic bonding in metal carbonyls. (5)
5. a) Which metals form dinitrogen complexes? Which other ligands can coexist in a nitrogen metal complex? Give any two examples of such complexes are prepared by using nitrogen gas directly. Give suitable chemical equations. (5)
b) How are dioxygen adducts of cobaltocenes prepared? (5)
6. a) Give an example of a transition metal-dinitrogen complex. Give suitable chemical equation for its preparation. In what fashion can the two metal atoms be bridged by dinitrogen? What happens when the dinitrogen ligands bind in side-on mode? Give suitable diagrams. (5)
b) With the help of suitable diagram explain the Tolman cone angle in phosphines. (5)
7. a) Give a suitable chemical equation for the preparation of molybdenocene. Give its reaction with ethylene. (5)
b) What are heterocarboranes? Which elements are involved in it? With suitable equation give the preparation of any one multidecker metal sandwich complexes. (5)
8. a) What is Jahn Teller effect? As a manifestation of it show why high-spin d^4 (e.g., Cr^{2+}) and low-spin d^7 six-coordinate complexes (e.g. Co^{2+}) may show distortion. (5)

- b) Give the octahedral as well as tetrahedral field electronic configuration for the Cr^{3+} and Mn^{2+} ions. Which site will be preferred by these ions, octahedral or tetrahedral? Justify your answer. (5)
9. a) With the help of a suitable diagram explain the trend of paramagnetic moments of La^{3+} and the lanthanoid ions at 300K. Why is the chance of superexchange interaction less in lanthanoid complexes? (5)
- b) With a suitable example explain intermolecular antiferromagnetism. Give its mechanism for the case of direct metal-metal interaction. Give suitable illustrations. (5)
10. a) What are Racah parameters? What do they signify? The gas-phase ion V^{3+} has a 3F ground term. The 1D and 3P terms lie, respectively, 10,642 and 12,920 cm^{-1} above it. The energies of the terms are given in terms of Racah parameters as $E(^3F) = A - 8B$, $E(^3P) = A + 7B$, $E(^1D) = A - 3B + 2C$. Calculate the values of B and C for V^{3+} . (5)
- b) What is meant by the octant sign? How can you follow the octant rule to determine the absolute configuration of cyclic ketones? How do we confirm whether a complex is Δ -isomer or Λ -isomer? (5)