BCHCT-137

ASSIGNMENT BOOKLET

Bachelor's Degree Programme
(BSCM)

COORDINATION CHEMISTRY, STATES OF MATTER & CHEMICAL KINETICS

Valid from 1st January, 2026 to 31st December, 2026

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)

Dear Student,

Please read the section on assignments in the Programme Guide for B. Sc. 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 it consists of two parts, Part A and B. It covers all blocks of the course. The total marks of all the parts are 100, of which 35% 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:

ROLL NO.: ……

NAME: ……

ADDRESS: ……

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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 January, 2026 to 31st December, 2026**. If you have failed in this assignment or fail to submit it by December, 2026, then you need to get the assignment for the year 2026, 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

BCHCT-137: COORDINATION CHEMISTRY, STATES OF MATTER & CHEMICAL KINETICS

Course Code: BCHCT-137
Assignment Code: BCHCT-137/TMA/2026
Maximum Marks: 100

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

PART A: COORDINATION CHEMISTRY

1. Give the name and symbols for the elements that have the following valence configurations. (5)

   i) $4s^1 3d^5$ ii) $5s^2 4d^5$ iii) $5s^2 4d^{10}$ iv) $5s^1 4d^8$ v) $4s^1 3d^{10}$ vi) $5s^1 4d^4$

2. In $[Cu(H_2O)_6]^{2+}$ the observed magnetic moment is higher than the spin-only value. Explain the reason for this in the space provided below. (5)

3. What is the general pattern of electronic configuration of the lanthanoids? Give the three exceptions to this. (5)

4. Determine the coordination number and the oxidation state of the transition metal ion in each of the following complex: (5)

   (a) $[Co(NH_3)_6]^{3+}$ (b) $[CuCl_4]^{2-}$, (c) $[Cu(NH_3)_4]Cl_2$, (d) $K_2[PtCl_6]$

5. Explain why Co(III)–NO_2 (nitro) complexes slowly convert into Co(III)–ONO (nitrito) complexes or vice versa. (5)

6. According to valence bond theory, how do you account for the indicated molecular geometry for the following compounds: (5)

   (i) $[Co(NH_3)_6]^{3+}$ - Octahedral and (ii) $[ZnCl_4]^{2-}$ - Tetrahedral

7. Explain polymerization ligand isomerism with suitable example. (5)

8. What would be the CFSE for an octahedral complex of a d^6 ion in weak field and strong field? (5)

9 Six-coordinate d^9 complexes of copper (+2) show pronounced tetragonal distortions. High-spin d^4 (e.g., Cr^{2+} and Mn^{3+} and low-spin d^7 six-coordinate complexes (e.g. Co^{2+} and Ni^{3+}) may show a similar distortion, but complexes of these ions are less common, and the distortions are less pronounced than those in copper (+2). Why? (5)

10. Determine how many unpaired electrons are contained in the following octahedral complex ions: $[Co(CN)_6]^{3-}$, $[CoF_6]^{3-}$ Estimate the magnetic moments of these complexes. (5)

PART B: STATES OF MATTER & CHEMICAL KINETICS

11. a) How many molecules of oxygen are present in 0.0032 kg of the gas? (2)

    b) Calculate the temperature at which the root mean square velocity, the average velocity and the most probable velocity of the oxygen gas are all equal to 1500 ms^{-1}. (3)

12. Calculate the pressure of 3.000 mol of methane at 298.2 K using the other data from the above illustration and assuming that it obeys van der Waals equation. Also calculate its value, if methane were to behave ideally at 298.2 K. (5)

13. What is meant by total attractive interaction energy in molecules? Explain the factors that influence its magnitude. (5)

14. With suitable diagrams, explain the plane of symmetry in a cubic system. (5)

15. Explain the seven primitive unit cells in crystals. Give suitable diagrams. (5)

16. The density and cell-edge length of potassium chloride (KCl) are 1.99×10^3 kg m^{-3} and 6.29×10^{-10} m, respectively. Using these data, determine the number of formula units per unit cell of potassium chloride crystal. (5)

17. a) In the decomposition reaction of hydrogen iodide, given below (2)

$$2HI\ (g) \rightarrow H_2(g) + I_2\ (g)$$

find out the relationship between the rate of reaction in terms of decomposition of HI and in terms of formation of H_2 (g).

b) Give the factors affecting the rate of a reaction. How do catalyst affect the rate of the reaction? (3)

18. a) What is the effect of pressure and temperature on the viscosity of gases? Explain briefly. (2)

b) What are the differences in the behaviour of real and ideal gases? Derive the expression for the critical temperature of a van der Waals gas. (3)

19. a) Write the differential rate equations for the following reactions, assuming them to be elementary reactions: (2)

i) $2A + 5B \rightarrow 3C + 2D + E$

ii) $A + 2B \rightarrow 3C$

b) Azomethane $(CH_3)_2N_2$ decomposes with first order kinetics according to the equation (3)

$(CH_3)_2N_2(g) \rightarrow N_2(g) + C_2H_6(g)$

The following data were obtained for the decomposition in a 200 ml flask at 300°C.

Time (t) in min	0	15	30	48	95
Total pressure, torr	36.2	42.4	46.5	53.1	59.3

Calculate the rate constant and the half-life for this reaction.

20. a) Calculate the activation energy of a reaction whose rate constant is tripled by a 10°C rise in temperature in the vicinity of 32°C. (2)

b) Discuss the activated complex theory of biomolecular reactions. Explain how this theory helps in evaluating standard enthalpy of activation and standard entropy of activation. (3)