

ASSIGNMENT BOOKLET

Post Graduate Diploma in Analytical Chemistry (PGDAC)

Basic Analytical Chemistry	(MCH – 001)
Separation Methods	(MCH – 002)
Spectroscopic Methods	(MCH – 003)
Electroanalytical & Other Methods	(MCH – 004)

(Valid from January 1, 2026 to December 31, 2026)

**It is compulsory to submit the assignment before filling in
the examination form.**



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

Dear Learner,

This assignment booklet consists of the tutor marked assignments of MCH- 001, MCH- 002, MCH – 003 and MCH – 004 courses of the Post Graduate Diploma in Analytical Chemistry (PGDAC) programme. We hope, you are familiar with the system of evaluation to be followed for this Programme. You may probably like to re-read the section on assignments in the Programme Guide that was sent to you earlier. As you are aware, a weightage of 30 percent has been earmarked for continuous evaluation component. For this you have to submit the responses of the enclosed tutor marked assignments to the Study Centre Coordinator. The assignments are based on the content of all the blocks of all the courses.

Before attempting the assignment, please read the following instructions carefully.

- 1 On top of the first page of your assignment response, please write the details exactly in the following format; write your answers from second page onwards.

ENROLMENT NO. :

NAME :

ADDRESS :

.....

.....

COURSE CODE :

COURSE TITLE :

ASSIGNMENT NO. :

STUDY CENTRE :

DATE :

(NAME AND CODE)

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

- 2 Use only foolscap size paper (but not of very thin variety) for writing your answers.
- 3 Leave about 4 cm margin on the left, top and bottom of your assignment response sheet.
- 4 Your answers should be precise.
- 5 While writing answers, clearly indicate the Question No. and part of the question being solved.
- 6 Though the validity of assignment is for one year, we advise you to submit the assignment response within 12 weeks after receiving it.
- 7 **We strongly suggest that you should retain a copy of your assignment responses.**

Wishing you good luck

TUTOR MARKED ASSIGNMENT

SPECTROSCOPIC METHODS

Course Code: MCH-003
Assignment Code: MCH-003/TMA/2026
Maximum Marks: 100

Note: Answer all the questions given below.

1. a) What is wave number? How is it related to wavelength? (2)
b) What is unpolarised light? How can it be polarised? (3)
c) Calculate the absorbance and transmittance of a 0.002 40 M solution of a substance having a molar absorptivity of $313 \text{ M}^{-1} \text{ cm}^{-1}$ in a cell with a path length of 2.00 cm. (5)
2. a) The UV-VIS spectrum in gaseous phase is observed to be a band spectrum whereas in solution phase it is a smooth and continuous absorption peak. Explain. (5)
b) Discuss the factors responsible for the deviation from Lambert-Beer's law. (5)
3. a) What is the role of a detector in a spectrophotometer? Explain the principle of photomultiplier tube as a detector. (5)
b) Discuss the standard addition method for generating a calibration curve. Under what conditions does this method become important? (5)
4. a) What is the selection rule for the vibration spectroscopy? Explain the origin of fundamental, first overtone and second overtone in the IR spectrum. (5)
b) Describe is KBr pelleting method for handling solid samples in IR spectroscopy. (3)
c) Calculate the number of vibrational modes for a molecule of methane. (2)
5. a) Explain the origin of Rayleigh and Raman lines with the help of an energy level diagram. (5)
b) Discuss different modes of relaxation for an electronically excited molecule using the Jablonski diagram. (5)
6. a) Discuss different factors affecting fluorescence. (5)
b) Discuss the fate of a sample introduced in the flame. (5)
7. a) Discuss the merits and demerits of Flame photometric method. (5)
b) Enlist different pathways for atomic fluorescence emission and explain Stokes direct line fluorescence method. (5)
8. a) The choice of proper reagents and techniques of decomposition and dissolution of the sample is a critical step for the success of AAS determination. Explain the preparing sample for AAS using microwave digestion system. (5)
b) List the characteristics of an ideal atomization-excitation source. (5)
9. a) Draw a schematic layout of different components of an ICP-AES spectrometer and briefly state the role of each component. (5)
b) Explain different relaxation mechanisms by which these operate to maintain population difference in nuclear spin states in NMR. (5)

10. a) What are isotopic peaks? Discuss the importance of isotopic peaks in mass spectrometry. (5)
- b) The important spectral details of an organic molecule having a molecular formula C_4H_8O are as follows:
- Mass: (Prominent peaks at m/z 29, 43 (base peak); 57 and 72 (M^+))
- IR : (2950 cm^{-1} (medium); 1718 cm^{-1} (strong); 1370 cm^{-1} (medium); and 1150 cm^{-1} (medium))
- NMR: (δ = 0.92 (3H, triplet); δ = 1.95 (2H, singlet) and δ = 2.6 (3H, quartet))
- Determine the structure of the organic molecule. (5)