

ASSIGNMENT BOOKLET**Spectroscopy****Bachelor's Degree Programme (B.Sc.)****(Valid from 1st January, 2025 to 31st December, 2025)****Please Note**

- You can take electives (56 to 64 credits) from a minimum of TWO and a maximum of FOUR science disciplines, viz. Physics, Chemistry, Life Sciences and Mathematics.
- You can opt for elective courses worth a MINIMUM OF 8 CREDITS and a MAXIMUM OF 48 CREDITS from any of these four disciplines.
- At least 25% of the total credits that you register for in the elective courses from Life Sciences, Chemistry and Physics disciplines must be from the laboratory courses. For example, if you opt for a total of 64 credits of electives in these 3 disciplines, at least 16 credits should be from lab courses.
- You cannot appear in the Term-End Examination of any course without registering for the course. Otherwise, your result will not be declared and the onus will be on you.



**School of Sciences
Indira Gandhi National Open University
New Delhi
(2025)**

Dear Student,

We hope, you are familiar with the system of evaluation to be followed for the Bachelor's Degree Programme. At this stage you may probably like to re-read the section on assignments in the Programme Guide that we sent you after your enrolment. A weightage of 30 percent, as you are aware, has been earmarked for continuous evaluation, which would consist of one tutor-marked assignment. The assignment is based on Blocks 1, 2, 3 and 4.

Instructions for Formatting Your Assignments

Before attempting the assignments, 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:.....
(NAME AND CODE)

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 While writing answers, clearly indicate the Question No. and part of the question being solved.
- 6 Please note that:
 - i) The Assignment is valid from 1st January, 2025 to 31st December, 2025.
 - ii) The response to this assignment is to be submitted to the Study Centre Coordinator within eight weeks of the receipt of this booklet in order to get the feedback and comments on the evaluated assignment.
 - iii) In any case, you have to submit the assignment response before appearing in the term end examination.
- 7 **We strongly suggest that you should retain a copy of your assignment responses.**

Wishing you all good luck.

Tutor Marked Assignment CHE-10: Spectroscopy

Course Code: CHE-10
Assignment Code: CHE-10/TMA/2025
Maximum Marks: 100

Note: * This assignment is based on all the four Blocks of the entire course.
* All questions are compulsory. Marks for the questions are shown within brackets on the right hand side.
* Please answer in your **own words**; do not copy from the course material.

1. What is Rydberg constant? Calculate its value. Why is its experimental value different from the calculated value? (5)
2. Derive the symbol for the ground state of hydrogen atom. (5)
3. Write the symmetry elements and the point groups of the following: (5)
(i) Water (ii) Ammonia (iii) Benzene
4. Derive the expression $E_k = \frac{1}{2I\omega^2}$. (5)
5. The transition from $J = 0$ to $J' = 1$ for HCl takes place at $\nu = 21.18 \text{ cm}^{-1}$. Calculate the bond length for $^1\text{H}^{35}\text{Cl}$. (5)
6. What is anharmonicity? Draw a diagram for the variation of potential energy with intermolecular distance for an anharmonic and harmonic oscillator (5)
7. Draw and explain the normal modes of vibration of water molecule. (5)
8. Which functional groups are expected to absorb in the $2000 - 1500 \text{ cm}^{-1}$ region of IR spectrum? Explain. (5)
9. Discuss the pure rotational spectrum of CO_2 using the suitable diagram (5)
10. Give the selection rules and the schematic diagram of the vibration-rotation Raman spectrum of a diatomic gas. (5)
11. Derive the term symbol for the ground state of LiH. (5)
12. How does solvent polarity affect $\pi-\pi^*$ and $n-\pi^*$ transitions? Explain. (5)
13. Give reason for the following: (5)
(a) Mercury (II) iodide is brick red in colour.
(b) The aqueous solution of NiSO_4 which is pale green turns deep blue on addition of ethylenediamine
14. Answer the following: (5)
(i) What is the role of litron mirror in IR spectrometer?
(ii) Why glass cell cannot be used for IR spectroscopy?
(iii) What are the basic requirements of any container which holds the sample?
(iv) What is the role of Water jacket in Raman Spectrometer?
(v) What is the role of Golay cell in IR spectrometer
15. Draw and explain the NMR spectrum of CH_3CHO . (5)
16. The hydrogen atoms attached to a double bond are deshielded while in case of alkynes the protons are shielded. Explain. (5)

17. Draw and explain the important components of an ESR spectrometer. (5)
18. Discuss the ESR spectrum of ethyl radical. (5)
19. What is simple cleavage? Illustrate with the help of a suitable example. (5)
20. Discuss the expected spectral data for $C_6H_5CH_2OH$. (5)