

ASSIGNMENT BOOKLET**Spectroscopy****Bachelor's Degree Programme (B.Sc.)****(Valid from 1st January, 2023 to 31st December, 2023)****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
(2023)**

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 1stJanuary, 2023 to 31stDecember, 2023.
 - 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/2023
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.
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1. Discuss the vector nature of angular momentum giving a suitable diagram. (5)
2. What is Rydberg constant? Show that its value is $1.09737 \times 10^7 \text{ m}^{-1}$. (5)
3. Illustrate improper axis of rotation giving a suitable example. (5)
4. Write the symmetry elements and point groups of the following molecules: (5)
(i) CH_4 (ii) SF_6 (iii) BF_3
5. For NO molecule, the rotational constant, B is 1.70 cm^{-1} . Calculate its bond length. (5)
6. Explain the following: (5)
(i) A Harmonic oscillator
(ii) Hooke's law
7. Discuss the IR spectrum exhibited by CO_2 molecule giving the suitable diagram. (5)
8. Which absorptions of different molecules appear in the $1500\text{-}600 \text{ cm}^{-1}$ region of IR spectra? Explain. (5)
9. What are the selection rules for rotational Raman spectra of linear molecules? Draw a Schematic diagram for pure rotational Raman spectrum of a diatomic molecule. (5)
10. Explain the shape of ClO_3^- ion using its IR and Raman spectra. (5)
11. Derive the term symbols for O_2 molecule. (5)
12. Discuss the effect of change of polarity of the solvent on the following transitions: (5)
(i) $\pi \rightarrow \pi^*$
(ii) $n \rightarrow \pi^*$
Draw a suitable diagram.
13. Explain giving a suitable diagram, the crystal field splitting of orbitals of metal ion in complexes having different geometries. (5)
14. Explain the following terms: (5)
(i) Vibrational relaxation
(ii) Fluorescence and phosphorescence quenching.
15. (a) Answer the following in two to three sentences: (3)
(i) Glass container cannot be used for IR spectroscopy?
(ii) What are the basic requirements of any container which holds the sample?
(iii) What is the significance of monochromators?
(b) Draw the block diagram for the following: (2)
(i) Raman spectrometer
(ii) IR spectrometer

16. (a) What is nuclear magneton? Calculate its value for a proton. (5)
(b) Give two examples each for nuclei having
 $I = 0$ and $I = 1$
17. Explain chemical shift. How it is expressed? (5)
18. Discuss the ESR spectrum of hydrogen atom giving a suitable diagram. (5)
19. Discuss the mass spectrum of 2-methylpentane giving the fragments formed. (5)
20. What would be different signals observed in the spectra of 4-ketobutanoic acid? Explain which structural units are responsible for these spectral signals. (5)