

ASSIGNMENT BOOKLET**Spectroscopy****Bachelor's Degree Programme (B.Sc.)****(Valid from 1st January, 2020 to 31st December, 2020)****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
(2020)**

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, 2020 to 31stDecember, 2020.
 - 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/2020
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. Illustrate what is an electromagnetic radiation. Define various parameters associated with it. (5)
2. What are term symbols? Derive the term symbols for the p state of the hydrogen atom. (5)
3. (a) Give the shapes of the following molecules: (3)
 - (i) HgCl_2
 - (ii) SnCl_2
 - (iii) ClF_3
 - (iv) XeF_4
 - (v) PCl_5
 - (vi) PF_3

(b) Show that a two fold axis of symmetry is present in water molecule. (2)
4. Illustrate the symmetry elements present in benzene molecule. What is its point group? (5)
5. Discuss the origin of various spectral lines the rotational spectrum of a diatomic molecule. Draw a suitable diagram also. (5)
6. Draw and explain the infrared spectral bands for HCl molecule. (5)
7. Explain the following terms: (5)
 - (i) Vibrational term value
 - (ii) Anharmonicity
8. (a) How many normal modes of vibration are possible for a (5)
 - (i) linear molecule, and
 - (ii) Non-linear molecule?

b) Draw the stretching and bending modes for >CH_2 group. (3)
9. Briefly explain the bands which are observed in the $4000\text{-}2500\text{ cm}^{-1}$ region of IR spectra for various organic molecules. (5)
10. Discuss important aspects of polarised Raman spectrum. (5)
11. Explain Born-Oppenheimer approximation with the help of a suitable diagram. (5)
12. Write the ground state electronic configuration of ethylenic chromophore. Discuss the possible electronic transitions for this chromophore using a suitable diagram. (5)
13. Give reason for the following: (5)
 - (i) Mercury iodide is red in colour.
 - (ii) An aqueous solution of NiSO_4 is green in colour which turns deep blue on addition of ethylenediamine.

14. Discuss the predissociation using a suitable diagram. (5)
15. (i) What is the role of Littrow mirror in IR spectrometre? (5)
(ii) Why can glass cell not be used for IR spectroscopy?
(iii) What is the significance of monochromators?
(iv) What are the sources of radiation in Raman spectrometre?
(v) What is the significance of laser beam in Raman spectroscopy?
16. What is nuclear Zeeman effect? Why is this observed? Explain. (5)
17. What is relaxation phenomenon? Explain its importance and different types. (5)
18. How is an esr spectrum recorded? Explain. Also draw the block diagram of the esr spectrometer. (5)
19. Explain simple cleavage for alkanes and the fragments obtained in the mass spectrum by taking a suitable example. (5)
20. Explain the spectral data expected for 2-butanone. (5)