

2022

M.Sc.

4th Semester Examination (CCAEE)

CHEMISTRY

PAPER—CEM-401

ADVANCED SPECTROSCOPY-II

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group—A

Answer any four questions. 4×2

1. Write note on NMR relaxation times.
2. Explain why NMR sensitivity is increased when the applied magnetic field is increased.
3. What is meant by anisotropic effect? Draw a diagram for the anisotropic effect of ethylene.

(Turn Over)

4. Write down the name of software for the analysis of secondary and tertiary protein structure.
5. What is the unit of molar ellipticity?
6. Explain how salicylic acid and its *meta* isomer can be distinguished by mass spectrometric analysis.

Group—B

Answer any *four* questions.

4×4

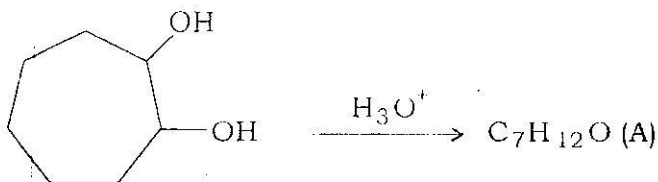
7. Illustrate 'double irradiation' with a suitable example.
8. Draw the diagram of an EI mass spectrometer.
9. Explain how 2-butanone and butyraldehyde can be differentiated by mass spectrometry.
10. The ^1H NMR spectrum of a solution of 1,3-dimethylcyclopentadiene in conc. sulphuric acid shows three signals with relative intensities of 6 : 4 : 1. Propose an explanation for the appearance of the spectrum.
11. Write short notes on different types of polarized light.
12. Write down the criteria for the preparation of sample for CD spectroscopy.

Group—C

Answer any *two* questions.

2×8

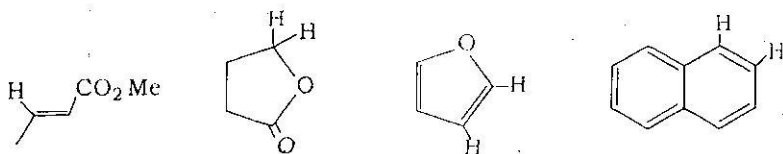
13. Propose a structure for the product A of the following reaction from the given data.



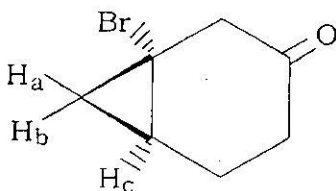
The spectral data for product [A] : IR: 1729 cm^{-1} ; $^1\text{H NMR } (\delta)$: $^1\text{H NMR}$: 9.72 (d, 1H), 2.30 (sex, 1H), 1.4-1.8 (m, 10H). Note that the signals for 10H overlapping are due to both equivalent and non-equivalent hydrogens.

14. Assign a δ value to each of the indicated hydrogens of the following structures.

The possible numbers are 4.3, 6.3, 7.00, 7.32, 7.4, 7.65. Justify your assignments.



15. For the compound below.



$$J_{ab} = 5.3\text{Hz} \quad J_{ac} = 8.3\text{ Hz} \quad J_{bc} = 10.7\text{ Hz}$$

- (i) how many ^1H NMR signals would you expect for the molecule?
- (ii) H_a appears as a dd at 1.32 ppm. Draw a labelled splitting tree diagram for H_a using the given coupling constant values.

16. (a) Explain Nuclear Zeeman Effect in Mössbauer spectroscopy.

- (b) Differentiate between $\text{K}_4[\text{Fe}(\text{CN})_6]$ and $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$ by Mössbauer spectroscopy.

4+4