

Exam. Code : 107406

Subject Code : 1882

B.Sc. (Biotechnology) 6th Semester

**BT-7 : PHYSICAL, ORGANIC AND INORGANIC
ASPECTS OF SPECTROSCOPY-B**

Time Allowed—3 Hours] [Maximum Marks—40

Note :— Attempt **all** questions of Section A and it is compulsory. Do any **five** questions from Section B and do any **two** questions from Section C.

SECTION—A(Compulsory, do **all** questions)

1. ^1H NMR spectrum of compound A was recorded in CDCl_3 (99%) deuterated. It showed a signal at 7.26 ppm which is not due to compound A. What is the origin of the signal ? 1
2. Suppose ^1H NMR spectrum of methanol (CH_3OH) is recorded at a concentration of 10^{-3} M and OH proton showed a quartet at 4.5 ppm. In which direction this quartet shall move : to low field or high field, if concentration is changed to 10^{-4} M ? Give suitable explanation. 1
3. Suppose you are recording ^1H NMR spectrum of compound B using 100 MHz NMR probe. What is Larmor frequency of the spinning proton for resonance ? Give explanation. 1

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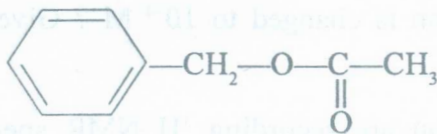
(Contd.)

4. What type of magnets are used in FT NMR spectrometer? Is FT NMR a single scan technique or a multiscan technique? 1
5. From the mass spectrum of benzene discuss major ions you can identify. 1
6. What is Nitrogen rule as used in mass spectrometry? 1
7. Methyl bromide showed two molecular ions which nearly same intensity. Write the molecular ions : (^{79}Br 51% abundance; ^{81}Br 49% abundance). 1
8. What is the most important information which we can get from the mass spectrum of a compound? Explain with a suitable example. 1

SECTION—B

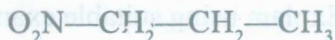
(Do any **five** questions)

9. The ^1H NMR spectrum of benzyl acetate (A) showed three signals at 2.3, 5.4 and 7.5 ppm. Assign these signals to the respective type of protons of compound. 4



A

10. Predict ^1H NMR spectrum of nitropropane. Draw the spectrum and explain occurrence of various peaks. Mark chemical shift and spin-spin coupling constants. 4



B

11. How protons of benzene appear at low magnetic field in its proton NMR spectrum? Explain the role of the ring current in this observation. 4
12. Suppose ^1H NMR spectrum of compound A (formula $\text{C}_2\text{H}_6\text{O}$) showed three signals: one triplet at $\delta = 2.5$ ppm; one quartet of doublets at $\delta = 3.5$ ppm and another triplet at $\delta = 5.5$ ppm. Suggest structure of compound with suitable justification. 4
13. Both n-butane and isobutane showed most intense peak at $m/z = 43$. Identify the species and also explain its high intensity. 4
14. Illustrate with an example, Diels-Alder fragmentation encountered in mass spectrometry of organic compounds. 4
15. What is the importance of metastable ions in mass spectrometry? Illustrate using a suitable example. 4
16. Describe mass spectrum of butyrophenone ($\text{C}_{10}\text{H}_{12}\text{O}$; MW 148). Illustrate Mc Lafferty rearrangement shown, if any, by this compound. 4

SECTION—C

(Do any two questions)

17. How the fragments of mass spectra of aliphatic and aromatic compounds differ ? Explain using suitable examples. 6
18. Explain the major mass spectral fragments and their intensity of the following compounds : cyclopentane (C_5H_{10}); toluene ($C_6H_5-CH_3$) and ortho-xylene $\{C_6H_4(CH_3)_2\}$. 6
19. The C-H protons of aliphatic compounds show proton NMR signals in the high field region, while those of aromatic rings show signals in the low field region. Explain the phenomenon/factors which govern this difference. Explain using suitable examples. 6
20. Describe in detail the basic principles of NMR spectroscopy with special reference to : NMR transition, solvents needed, chemical shift, nuclear spin-nuclear spin coupling constant, radiations used and advantages in respect of structure elucidation. 6