

Exam. Code : 107406

Subject Code : 2276

B.Sc. (Bio-Technology) 6th Semester
PHYSICAL, ORGANIC AND INORGANIC
ASPECTS OF SPECTROSCOPY—B

Paper—BT-7

Time Allowed—Three Hours] [Maximum Marks—40

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

SECTION—A

(Compulsory, do *all* questions)

1. What are values of molecular ions, $[M]^+$ and $[M + 2]^+$ of methyl bromide (atomic masses of two isotopes of Br = 79 and 81)? The natural abundance of both isotopes is nearly equal, how the intensities of ions will differ. 1
2. What is importance of a metastable ion in mass spectrometry? 1
3. Predict the positions and formulas of $[M]^+$ and two most stable fragment ions of benzaldehyde in its mass spectrum (atomic mass, C = 12, H = 1, O = 16). 1
4. Aminoethanol ($\text{NH}_2\text{—CH}_2\text{—CH}_2\text{—OH}$) showed two intense ions at $m/z = 30$ and 31 . Suggest the ions and indicate which one will be more intense than the other. Give reasons (atomic mass, C = 12, H = 1, N = 14). 1

5. Draw and explain proton NMR spectrum of methanol. 1
6. Compound A showed one NMR signal at $\nu_s = 400$ Hz and if the frequency is 200 MHz, what is the value of δ in ppm (reference frequency, $\nu_R = 0$ Hz). 1
7. What is the use of tetramethylsilane in NMR spectroscopy? How many signals does it show? 1
8. Proton NMR spectrum of methyl fluoride showed a doublet. Explain the origin of the doublet (each of ^1H and ^{19}F have nuclear spin $I = \frac{1}{2}$). 1

SECTION—B

(Do any five questions)

9. Butyric acid $\{\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—C(=O)—OH}\}$ showed a molecular ion $[\text{M}]^+$ at $m/z = 88$. Explain how it forms a most intense ion at $m/z = 60$ and another significant ion at $m/z = 45$. 4
10. An aromatic compound [MW, 136] showed various ions at $m/z = 136, 105$ and 77. Suggest possible structure of the aromatic compound. 4
11. Describe important factors which influence cleavage patterns. 4
12. What are different components and their function of a mass spectrometer? Also draw schematic diagram of a mass spectrometer. 4
13. Explain spin-lattice and spin-spin relaxation phenomena encountered in NMR spectroscopy. 4

14. Suggest some deuterated solvents used for recording NMR spectra of compounds. What is necessity of deuterated solvents ? 4
15. Draw and explain proton NMR spectra of ethylbromide and ethylacetate. From the spectrum how will you find δ and J values. 4
16. Draw and explain proton NMR spectra of toluene and acetaldehyde. 4

SECTION—C

(Do any two questions)

17. Using suitable examples (at least three) explain McLafferty rearrangement encountered in mass spectrometry. 6
18. Taking one example in each case, describe mass spectra of an aldehyde, a ketone and an ester. 6
19. How CW and FT NMR techniques differ ? Discuss advantages of FT over CW NMR technique. 6
20. What are basic principles of NMR spectroscopy ? Explain NMR transition. How radio frequency radiations interact with the spinning nucleus ? 6