

Exam. Code : 107406

Subject Code : 2336

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

Paper-BT-7

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. Write three main requirements for observing ^1H NMR spectrum. 1
2. How many ^1H NMR signals are shown by the reference compound $\text{Si}(\text{CH}_3)_4$? 1
3. Depict ^1H NMR spectrum of ethyl bromide. 1
4. Name at least two solvents used for recording ^1H NMR spectrum of a compound. Give suitable reasons for your choice. 1
5. What is the major information we can get from the mass spectrum of a compound ? Explain with a suitable example. 1

6. From the mass spectrum of toluene, discuss three major ions you can identify. 1
7. Explain Nitrogen rule as used in mass spectrometry. 1
8. ^{79}Br and ^{81}Br have nearly equal abundance, then suggest various molecular ions obtained from Mass spectrum of methyl bromide. 1

SECTION-B

(Do any five questions)

9. Benzonitrile ($\text{C}_6\text{H}_5\text{CN}$) showed three major mass peaks at : $m/z = 103$ (100 %); 77 (10 %) and 76 (35 %) positions. Suggest which are possible species formed. The values in brackets are relative abundances of ions formed (Atomic masses : C = 12, H = 1; N = 14). 4
10. Ethylamine showed three major mass peaks at : $m/z = 45$ (20 %); 21 (21 %) and 30 (100 %) positions. Suggest which are possible species formed. The values in brackets are relative abundance of ions formed. 4
11. How metastable ions are generated ? What is their importance in mass spectrometry ? 4
12. Illustrate Mc Lafferty rearrangement using one example. 4
13. It is found that in proton NMR spectrum of a compound, there are only a small number of nuclei more in the ground state as compared to that in the excited state when NMR spectrum is recorded. How then this number is maintained and no saturation of the NMR system occurs ? Discuss relaxation phenomena which do this job. 4

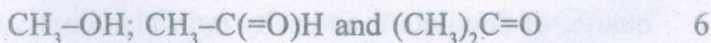
14. Suppose ^1H NMR spectrum of compound A shows one triplet in intensity ratio (1 : 2 : 1) at $\delta = 2.5$ ppm; one quartet of doublets in intensity ratio (1 : 3 : 3 : 1) at $\delta = 3.5$ ppm and one triplet in intensity ratio (1 : 2 : 1) at $\delta = 5.5$ ppm. Suggest structure of compound with suitable justification. 4
15. The OH proton NMR signal of p-nitrophenol undergoes shift to highfield when concentration of p-nitrophenol is decreased; while OH proton of o-nitrophenol did not change its position with concentration. Explain this behaviour of two compounds. 4
16. Predict ^1H NMR spectrum of ethyl acetate
 $\{\text{CH}_3\text{-C(=O)-O-CH}_2\text{-CH}_3\}$ 4

SECTION-C

(Do any two questions)

17. Explain briefly : electron ionization (EI) and chemical ionization (CI) techniques used for formation of ions in mass spectrometry. 6
18. Give applications of mass spectrometry to :
- (a) alcohols and
 - (b) aromatic compounds.
- Describe main species and their relative abundance. 6

19. How will you distinguish the following three compounds using proton NMR spectroscopy ?



20. How proton NMR spectrum of a compound is recorded ? Give main components of a NMR spectrometer in the form of a sketch ? How CW and FT NMR techniques are different ? 6