



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

FIFTH SEMESTER – NOVEMBER 2017

CH 5513 / CH 5508 – FUNDAMENTALS OF SPECTROSCOPY

Date: 08-11-2017

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

PART –A

Answer ALL the questions

(10 x 2 =20 marks)

1. Arrange the following radiations in the increasing order of wavelength
X-Rays, Radiowaves, Microwaves, Visible
2. Define signal to noise ratio.
3. Acetone absorbs at $280 \text{ m}\mu$; ν_{max} 16000. Give reason
4. Calculate ν_{max} in the UV spectrum of 2,4-hexadiene
5. State Mutual Exclusion Principle
6. Calculate the vibrational degrees of Freedom in the following molecules
a) O_2 b) C_6H_6
7. How many signals are formed in the proton NMR of 2-chloropropane?
8. Why is TMS used as a reference in NMR?
9. What do you understand by Nitrogen rule?
10. How will you characterize a primary alcohol by mass spectrometry?

PART –B

Answer any EIGHT questions

(8 x 5 = 40 marks)

11. Describe the different regions of the Electromagnetic Spectrum
12. a) Calculate the energy associated with a radiation having wavelength 4000 \AA . Give answer in kcal mole^{-1} and kJ mole^{-1} .
b) What do you mean by selection rule in spectroscopy? **(3+2)**
13. Discuss the components of UV-Vis spectrophotometer using a neat block diagram
14. Explain the types of absorption and intensity shifts in electronic spectroscopy
15. IR spectrum of phenol exhibits peaks at 3330 cm^{-1} , 3040 cm^{-1} , 1580 cm^{-1} , 1360 cm^{-1} , 1220 cm^{-1} and 800 cm^{-1} . Assign these peaks with reasons to the structural feature of the compound.
16. How are inter and intra molecular hydrogen bonding identified in IR spectral analysis?
17. An organic compound of molecular formula $\text{C}_7\text{H}_7\text{NO}$ shows the following bands in the IR spectrum. 3360 and 3180 cm^{-1} , 1680 and 1640 cm^{-1} , 1600 , 1510 and 1460 cm^{-1} , 1150 cm^{-1} and 770 cm^{-1} . Deduce the structure of the compound

18. a) Acetylenic protons are more shielded than ethylenic protons. Explain.
 b) Explain Pascal's triangle (3+2)
19. Predict the no. of NMR signals for the following compounds
 i. Propanal ii. Diethylether iii. Ethyl benzene (5)
20. How do inductive effect and hydrogen bonding affect the normal position of a proton?
21. Explain the significances of isotopic and metastable peaks in mass spectral analysis
22. Determine the structure of the compound of molecular formula $C_4H_{10}O$ whose m/e values are m/e = 74(molecular ion), 56, 43, and 31 (base peak)

PART – C

Answer any FOUR questions

(4 x 10=40 marks)

23. Describe the principle, instrumentation and applications of Flame Photometry'
24. a) Describe the sampling technique used in IR spectrometry.
 b) Discuss the various types of stretching and bending vibrations observed in IR spectral analysis (5+5)
25. a) A compound with the molecular formula C_8H_8O gives the following PMR spectral data: (ppm): 9.78 (t, 1H), 7.28 (m, 5H), 2.8 (d, 2H). Identify the compound
 b) Define the term chemical shift and describe the influence of the anisotropic effect of carbonyls and hydrocarbons on chemical shift (4+6)
26. a) Discuss the types of electronic transitions in organic molecules with examples.
 b) The peaks due to n- * transitions are shifted to lower wavelengths as the polarity of the solvent is increased. Explain (5+5)
27. a) Explain McLafferty rearrangement with a suitable example
 b) Discuss the fragmentation pattern observed in i. Butyraldehyde ii. Toluene (4+6)
28. a) Describe the theory of Raman spectroscopy
 b) Distinguish between the following pairs of compounds with the help of Infrared technique
 i. Propanal and propanone
 ii. ethanol and dimethylether (4+6)
