

DURING THE ACADEMIC YEAR 2021-22 ONLY) REG.NO. **N.G.M.COLLEGE (AUTONOMOUS): POLLACHI****END-OF-SEMESTER EXAMINATIONS: DECEMBER – 2022****M.Sc. – CHEMISTRY****MAXIMUM MARKS: 70****III SEMESTER****TIME: 3 HOURS****SPECTROSCOPIC TECHNIQUES – APPLICATION IN ORGANIC CHEMISTRY****SECTION - A (10 X 1 = 10 MARKS)****ANSWER THE FOLLOWING QUESTIONS. (K1)**

1. The electromagnetic radiation in the frequency range  $10^{19} - 10^{17}$  Hz belongs to .....  
 a) UV spectrum b) X-rays c) IR d) Visible
2. The IR band spectra show the changes in vibrational and rotational energies of a molecule subject to selection rule.....  
 a)  $\Delta v = 0, \Delta J = \pm 1$  b)  $\Delta v = \pm 1, \Delta I = \pm 1$  c)  $\Delta v = \pm 1, \Delta J = \pm 2$  d)  $\Delta v = \pm 2, \Delta J = 0$
3. McLafferty rearrangement ion peak in mass spectrum is usually the basic peak for.....  
 a) Aldehydes b) Ketones c) Acids d) All of these
4. Which of the following solvents cannot be used in NMR spectroscopy?  
 a)  $CCl_4$  b)  $CS_2$  c)  $CHCl_3$  d)  $(CCl_3)_2C=O$
5. The natural abundance of  $^{13}C$  is about.....  
 a) Four times less than  $^1H$  b) 0.11% of total carbon  
 c) 1.1% of total carbon d) 99% of total carbon

**ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)**

6. Define Absorbance.
7. List the various types of bending vibrations.
8. What do you mean by base peak?
9. Why is TMS used as a reference standard in NMR spectroscopy?
10.  $^{13}C$  is NMR active while  $^{12}C$  is not. Comment. .

**SECTION – B****(5 X 4 = 20 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING****QUESTIONS. (K3)**

11. a) Explain the absorption laws.

**(OR)**

- b) Discuss the UV spectra of the following: (i) 1,3-butadiene (ii) naphthalene

**(CONTD .... 2)**

12. a) Examine the expected IR peaks for (i) P-nitrophenol (ii) P-nitrobenzoic acid and acetic anhydride.  
**(OR)**  
b) Enumerate the Rayleigh, Stoke's and Antistoke's lines.

13. a) Explain the theory of mass spectroscopy.  
**(OR)**  
b) Distinguish between three isomeric butanols on the basis of mass spectrometry.

14. a) Illustrate with examples of the i) shielding and ii) deshielding effects involved in NMR spectroscopy  
**(OR)**  
b) Distinguish between inter and intra-molecular hydrogen bonding on the basis of  $^1\text{H}$  NMR spectroscopy

15. a) Explain the Nuclear Overhauser Effect  
**(OR)**  
b) Discuss  $^1\text{H}$ - $^{13}\text{C}$  COSY spectra in  $^{13}\text{C}$ -NMR spectroscopy

**SECTION - C (4 X 10 = 40 MARKS)**

## **ANSWER ANY FOUR OUT OF SIX QUESTIONS**

**(16<sup>th</sup> QUESTION IS COMPULSORY AND ANSWER ANY THREE**

**QUESTIONS. (FROM Qn. No: 17 to 21)**

(K4 (Or) K5)

16. Justify the overtones and combination bands. Discuss the applications of IR spectra to organic compounds
17. Elaborate the various applications of the ultra-violet spectroscopy.
18. Elaborate the following:
  - a) Stretching and bending vibrations b) Fingerprint region c) Fermi resonance
19. Construct the general fragmentation modes and , explain with examples.
20. Outline a comparison on instrumentation of Continuous Wave NMR and FT- NMR
21. Elaborate HETCOR Spectroscopy with suitable examples and explain.

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