



Date: 28-06-2022

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

Part-A

Answer ALL questions.

(10 × 2= 20)

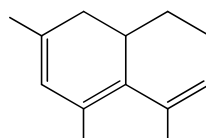
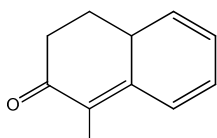
1. What is signal to noise ratio?
2. What would be the uncertainty in frequency and the nature of spectral lines when the lifetime of an excited state 10^{-7} sec?
3. The UV absorption peaks are usually broader than the IR absorption peaks. Justify.
4. What are monochromators?
5. Name any two sources used in Raman Spectroscopy.
6. What is meant by Finger Print region?
7. Distinguish isobutyl alcohol from n-butyl alcohol using ^1H NMR spectroscopy.
8. Name the reference used for recording water soluble compounds in ^1H -NMR.
9. State Nitrogen rule.
10. What is called Base peak in Mass spectroscopy?

Part-B

Answer any EIGHT questions.

(8 × 5= 40)

11. Write the differences between absorption and emission spectrum.
12. Calculate the energy of radiation having wavelength 2000 Å. Convert Joule into eV, cm, cm^{-1} and Kcal.
13. State and Explain Franck-Condon principle.
14. Describe the principle involved in flame photometry. Mention their applications.
15. Calculate the λ_{max} for the following molecules using Woodward-Fieser's rule:



16. Bring out the differences between IR and Raman spectroscopy.
17. Calculate the number of vibrational modes in a) CO_2 b) Water.
18. Discuss the EPR spectrum of high spin Mn(II) complex.
19. Explain the aromatic coupling observed in phenol and benzoic acids.

20. A compound of molecular formula C_6H_{14} has five isomers. These five isomers exhibit large difference in their splitting of signals by their nearest proton. Identify the five isomers and predict the NMR pattern for any three isomers.
21. Delineate retro-Diels-Alder type fragmentation in mass spectrometry.
22. Illustrate the block diagram of Mass spectrometer and mention the parts.

Part-C

Answer any **FOUR** questions.

(4 × 10 = 40)

23. a) What are the factors affecting width and intensity of the spectral lines?
 b) How is Boltzmann distribution law useful in calculating the relative population of electronic, rotational and vibrational energy levels at different temperatures? (6+4)
24. a) Draw and label the block diagram of double beam UV-Visible spectrophotometer and explain. (5+5)
 b) Discuss the effect of polar and non-polar solvents on π - π^* and n - π^* transitions.
25. a) How will you distinguish between the following by IR spectroscopy?
 (i) salicylic acid and p-hydroxy benzoic acid
 (ii) Inter and intramolecular H-bonding.
 b) Explain the quantum theory of Raman spectroscopy. (6+4)
26. a) What is spin-spin coupling? Explain it with an example.
 b) A compound B with molecular formula C_8H_9OCl has the following spectral features: IR: broad absorption from $3600-3400\text{ cm}^{-1}$
 ^{13}C NMR: δ 138, 131, 129, 127, 65, 39
 ^1H NMR: δ 7.50 d, J= 9.0, 2H 7.10 d, J= 9.0, 2H 3.70 t, J= 5.0, 2H 3.00 s, 1H 2.70 t, J= 5.0, 2H
 Deduce the structure of the compound B. (4+6)
27. a) Illustrate the hyperfine splitting of benzene and methyl radical.
 b) Discuss the factors affecting chemical shift values. (5+5)
28. a) Write the mechanism of McClafferty rearrangement. (5+5)
 b) Discuss various fragmentation patterns possible in MS with suitable examples.

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