



CHE 525

M.Sc. IVth SEMESTER EXAMINATION, 2023-24

5041

(CBCS MODE)

CHEMISTRY

(Spectroscopy-II)

Time : Three Hours]

[Maximum Marks : 75

Note: There are **three** sections (A, B and C) and Candidate has to attempt questions from all sections. Marks are indicated against each section

SECTION-A

1. Answer all questions. 5×3=15
- (a) How many molecular ion peaks do you expect in the mass spectrum of 4-chlorobromobenzene ?
- (b) An organic compound C_2H_2BrF gives two doublets with $J = 14.2 \text{ Hz}$ in its $^1\text{H} - \text{NMR}$ spectrum. Deduce its structure.
- (c) What are Massbauer Nuclides ? Give at least three examples.
- (d) Give basic differences between $^1\text{H} - \text{NMR}$ and $^{13}\text{C} - \text{NMR}$ spectrum.

- (e) How many signals do you expect in ESR spectrum of benzene free radical.

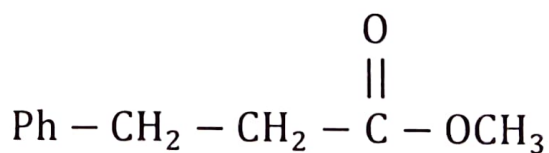
SECTION-B

Note : Answer all questions of the following . $4 \times 5 = 20$

2. (a) What is Massbauer Spectroscopy ? Explain Recoilless emission.

Or

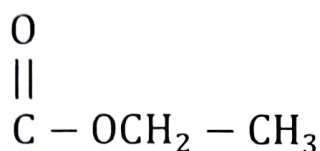
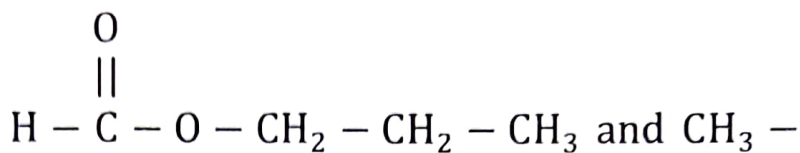
- (b) Discuss Mac-Lafferty fragmentation with examples.
3. (a) Give mass spectral fragmentation pattern of the following compound.



Or

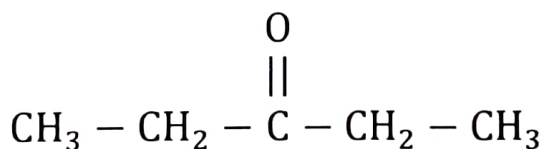
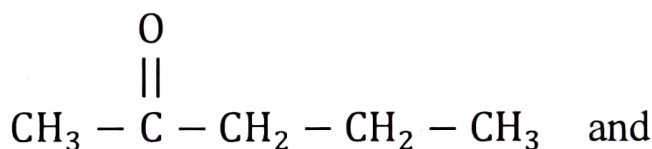
- (b) Describe the principle of ESR spectroscopy. How many signals are expected in hyperfine splitting of naphthalene free radical.

4. (a) Distinguish following isomers by ^1H - NMR spectroscopic method.



Or

- (b) Distinguish following isomers by mass spectrometry method.



5. (a) Write note on Nuclear Zeeman splitting.

Or

- (b) Write note on Nuclear Over house Effect.

SECTION-C

Note : Answer any two questions of the following. $2 \times 20 = 40$

6. What is spin-spin coupling in ^1H - NMR. Explain chemical shift. Deduce the structure of compound $\text{C}_7\text{H}_{12}\text{O}_4$ from following ^1H - NMR spectral data : $\delta 1.2$ (t, 6H) ; 3.4 (S, 2H) and 4.3 (q, 2H).

7. Write note on any three of the following.
- (i) 2 - D - NMR
 - (ii) DEPT ^{13}C - NMR
 - (iii) Shielding and deshielding in NMR
 - (iv) Massbauer spectra of $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{CN})_5\text{NO}]^{3-}$.
 - (v) Retro Diels-Alder fragmentation
8. Enumerate the factors on which line width of ESR signal depend. Give the significance of 'g' value in structure determination. Calculate the g value of the methyl radical with ESR signal at 3290 G (0.329 T) in a spectrometer operating at 9230 MHz.
9. Explain any four of the following :
- (i) Quadrupole splitting and its measurements.
 - (ii) ^{19}F and ^{31}P - NMR spectra of PF_2Cl_3 molecule
 - (iii) α , β and γ effects in ^{13}C - NMR.
 - (iv) First and non first order of spectra.
 - (v) Intensities of M^+ and $[\text{M} + 1]^+$ peaks in mass spectrum of $\text{C}_{20}\text{H}_{40}$.

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