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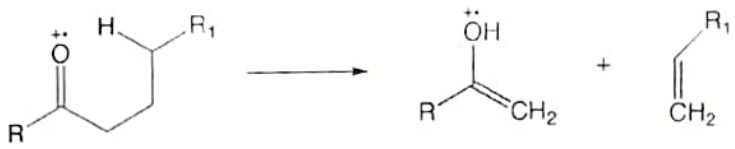
School: School of Science
Program: B. Sc. in Chemistry
Year: 3rd **Semester:** 5th
Examination: End Semester Examination
Examination year: December - 2022

Course Code: CH303 **Course Name:** SPECTROSCOPY AND SEPARATION TECHNIQUES
Date: 06/12/2022 **Total Marks:** 40
Time: 2:30 to 4:30 pm **Total Pages:** 2

Instructions:

- Write each answer on a new page.
- Use of a calculator is required.
- * COs=Course Outcome mapping. # BTL=Bloom's Taxonomy Level mapping

Q. No.	Details	Marks	COs*	BTL#																											
Q.1	Choose the most appropriate answers 1. Which of the following is required for a molecule to undergo McLafferty rearrangement? (a) α -H (b) β -H (c) γ -H (d) δ -H 2. Abundance of ^{13}C in nature is % (a) 0.9 (b) 1.1 (c) 1.2 (d) 1.3 3. Which of the following will be inactive in IR? (a) H_2O (b) NH_3 (c) S_8 (d) SO_2 4. Which of the following will have the greatest wavelength? (a) microwave (b) infrared (c) X-rays (d) visible 5. The number of NMR signals in 5-Hydroxyhexanoic acid is (a) 5 (b) 6 (c) 7 (d) 8	5	CO1, CO2, CO4	BT1, BT2, BT3, BT4, BT5																											
Q.2.	Match the following (Write full answers in the paper) <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Sr. No.</td> <td style="text-align: center;">Column A</td> <td style="text-align: center;">Column B</td> </tr> <tr> <td>1.</td> <td>pumps</td> <td>a) reverse phase chromatography</td> </tr> <tr> <td>2.</td> <td>$\text{C}_8, \text{C}_{18}$ column</td> <td>b) source of visible radiation</td> </tr> <tr> <td>3.</td> <td>paper chromatography</td> <td>c) helium</td> </tr> <tr> <td>4.</td> <td>carrier gas</td> <td>d) infrared spectroscopy</td> </tr> <tr> <td>5.</td> <td>change in dipole moment</td> <td>e) partition</td> </tr> <tr> <td>6.</td> <td>tungsten lamp</td> <td>f) TLC</td> </tr> <tr> <td>7.</td> <td>nitrogen rule</td> <td>g) HPLC</td> </tr> <tr> <td>8.</td> <td>R_f</td> <td>h) source of ultraviolet radiation</td> </tr> </table>	Sr. No.	Column A	Column B	1.	pumps	a) reverse phase chromatography	2.	$\text{C}_8, \text{C}_{18}$ column	b) source of visible radiation	3.	paper chromatography	c) helium	4.	carrier gas	d) infrared spectroscopy	5.	change in dipole moment	e) partition	6.	tungsten lamp	f) TLC	7.	nitrogen rule	g) HPLC	8.	R_f	h) source of ultraviolet radiation	9	CO1, CO2, CO4	BT1, BT2, BT3, BT4, BT5
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	9. deuterium lamp	i) Odd molecular weight		
Q.2	Write short notes on the following (a) Pascal's Triangle in NMR spectroscopy (b) Nitrogen Rule with appropriate examples (c) Explain with hypsochromic, bathochromic, hyperchromic and hypochromic shifts.		6	CO2, CO4 BT1, BT2, BT3, BT4
Q.3	Answer the following (Any two) (a) Calculate the molar absorptivity coefficient of 0.2M copper sulphate solution that shows a transmittance of 15%, when a cell of 1.5 cm is used. (b) Explain the role and calculation of R_f in Thin Layer chromatography. (c) Explain mechanism for the following McLafferty Rearrangement. 		6	CO3, CO4 BT1, BT2, BT3, BT4, BT5
Q.4	Explain the working of High Performance Liquid Chromatography using suitable block diagram. OR Explain types of bending and stretching vibrations observed in Infrared Spectroscopy.		5	CO3, CO4 BT2, BT3, BT4, BT5, BT6
Q.5	Deduce the structure of the molecule using the given NMR data. (Any three) (a) $C_6H_{14}O$: δ 1.0 doublet 12H, δ 3.1 septet 2H (b) $C_8H_{10}O$: δ 1.1 triplet 3H, δ 2.4 quartet 2H, δ 6.0 singlet 1H, δ 7.2 multiplet 4H (c) $C_4H_8O_2$: δ 1.1 triplet 3H, δ 2.4 quartet 2H, δ 3.6 singlet 3H (d) $C_8H_8O_2$: δ 3.6 singlet 3H, δ 7.3 multiplet 4H, δ 9.8 singlet 1H (e) C_8H_8O : δ 2.61 singlet 3H, δ 7.5 multiplet 5H		9	CO4 BT1, BT2, BT3, BT4, BT5, BT6

*****End of Question Paper*****