
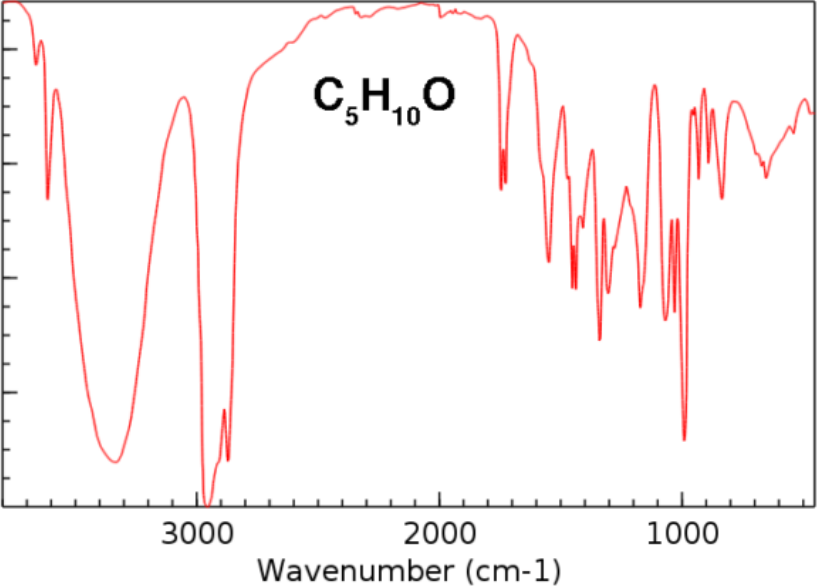


Name:			
Enrolment No:			
UPES End Semester Examination, December 2023			
Course: Instrumental Methods in Chemical Analysis Semester: V Program: BSc (H) Chemistry Course Code: CHEM3020		Time : 03 hrs. Max. Marks: 100	
Instructions: Answers should be clearly legible.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Categorize the various radiations on electromagnetic spectrum with proper illustration.	4	CO3
2	Write the conditions or selection rules required to achieve the following phenomenon. (i) absorption & (ii) emission Explain your answer with appropriate diagrams.	4	CO2
3	How will characteristic stretching frequencies of an organic compound be calculated? State the importance of this formula.	4	CO3
4	Discuss mass spectrum of methanol with proper explanation of peaks in the spectrum	4	CO3
5	Identify the radiation sources of the following radiations. (i) Ultraviolet (ii) visible and (iii) Infrared radiation	4	CO1
SECTION B (4Qx10M= 40 Marks)			
6	(a) Discuss the working of X-ray spectrometer and briefly mention the calculation of interplanar distance of a crystal with its help. (b) Determine the interplanar distance in a crystal in which the planes produce first order diffraction from an X-ray tube (with a wavelength of 1.53 Å) at an angle of 11.25°.	10	CO3
7	An organic compound molecular formula C ₅ H ₁₀ O undergoes IR analysis and the following spectrum has been obtained.	10	CO1

	 <p style="text-align: center;">C₅H₁₀O</p> <p style="text-align: center;">Wavenumber (cm⁻¹)</p> <p>From the spectrum identify the possible functional groups and information related to molecular structure of the compound.</p>		
8	<p>Draw and explain with a neat sketch of mass spectrometer and various components in it.</p>	10	CO3
9	<p>In a paper chromatography experiment for the separation of amino acids (AA), the following information is obtained on chromatogram. Using the information answer the following.</p> <p>AA 1 = 1.4 cm; AA 2 = 1.5 cm, AA 3 = 1.8 cm; AA 4 = 2.1 cm and solvent front has 4.4 cm.</p> <ol style="list-style-type: none"> 1. What is the R_f value for AA #2? 2. What is the R_f value for AA # 3? 3. What is the relative retention value for components #1 and # 4? 4. Using the answers from questions 1 and 2 and assume that components 2 and 3 are different compounds. Which component would be considered more polar? Explain. <p style="text-align: center;">OR</p> <p>Specify the various types of columns and detectors used in gas chromatography.</p>	10	CO2
<p>SECTION-C (2Qx20M=40 Marks)</p>			
10	<p>(a) Enlist the various components of UV-Visible spectrometer and brief description of each component. Use proper illustrations.</p> <p>(b) Explain the following by giving diagrams, formulas, energy level diagrams wherever necessary?</p>	10+10	CO1

	<p>(i) UV/Vis absorption bands due to $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ transitions shift to longer wavelengths with increasing solvent polarity.</p> <p>(ii) The absorbance maximum for hexatriene (C_6H_8) is observed at a longer wavelength than is the absorbance maximum for 1,3-butadiene ($CH_2=CH-CH=CH_2$).</p>		
11	<p>Describe the sample application method in the below mentioned techniques in detail.</p> <p>(i) Thin layer chromatography (ii) Gas chromatography OR</p> <p>Explain the following.</p> <p>(i) Hypochromic and bathochromic shift</p> <p>(ii) Molecular vibrations</p> <p>(iii) Systematic and random error</p> <p>(iv) Absorbance and transmittance</p>	10+10	CO2