
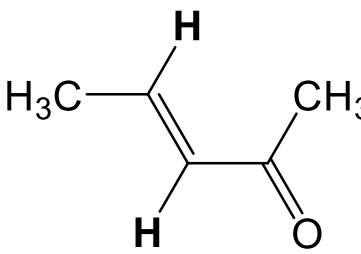
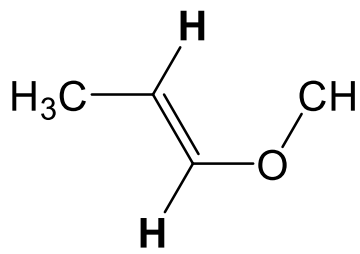


Name:			
Enrolment No:			
<b>UPES</b> <b>End Semester Examination, December 2024</b>			
<b>Course: Molecular Structure: Spectroscopic and Diffraction Methods</b> <b>Program: Integrated B.Sc M.Sc (Chemistry)</b> <b>Course Code: CHEM4001</b>		<b>Semester: VII</b> <b>Time: 03 hrs.</b> <b>Max. Marks: 100</b>	
<b>Instructions:</b> <ul style="list-style-type: none"> <li>▪ Attempts all questions.</li> <li>▪ Questions 9 and 10 are having internal choices.</li> </ul>			
<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
S. No.		Marks	CO
Q 1	Discuss Stokes shift in Raman spectroscopy.	4	CO1
Q 2	What is rock salt? Which ions are present in this salt? How do these ions arrange in the three-dimensional structure?	4	CO3
Q 3	Derive $n\lambda = 2d\sin\theta$ where $\lambda$ is the wavelength, $d$ = path difference, $\theta$ = angle of incident beam	4	CO3
Q 4	How many types of protons are present in the following molecule?  (a) CH <sub>3</sub> COOH; (b) CH <sub>3</sub> CH <sub>2</sub> OH	4	CO2
Q 5	Compare the potential radiative and non-radiative transitions in Emission spectroscopy.	4	CO2
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
Q 6	Describe Miller indices. Give some examples.	10	CO3
Q 7	Why do acetylenic protons more shielded than aromatic protons in NMR spectroscopy?	10	CO2
Q 8	What is the difference between the orthorhombic and monoclinic crystal systems?	10	CO3
Q 9	What is quenching in emission spectroscopy? How does it affect the intensity of emitted light?  Or  Why do some nuclei show doublet, triplet, or quartet patterns in <sup>1</sup> H-NMR spectra? Give appropriate examples.	10	CO3

**SECTION-C**  
**(2Qx20M=40 Marks)**

Q 10	<p>What is TMS (tetramethylsilane)? Why are the importance of TMS in NMR spectroscopy? How do thr “upfield” and “downfield” shifts are associated with TMS?</p> <p style="text-align: center;"><b>Or</b></p> <p>Outline fundamental differences and utilities of the X-ray diffraction, Electron diffraction and Neutron diffraction methods. How do these methods applicable in material characterizations?</p>	<b>20</b>	<b>CO3</b>
Q 11	<p>Why do the chemical shifts of <math>\alpha</math> and <math>\beta</math> protons vary in the given <math>\alpha, \beta</math>-unsaturated compounds? Explain in detail.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p><math>\alpha</math>-H at <math>\delta \sim 6.2</math> ppm <math>\beta</math>-H at <math>\delta \sim 6.8</math> ppm</p> </div> <div style="text-align: center;">  <p><math>\alpha</math>-H at <math>\delta \sim 6.2</math> ppm <math>\beta</math>-H at <math>\delta \sim 4.6</math> ppm</p> </div> </div>	<b>20</b>	<b>CO2</b>