

EASTERN UNIVERSITY SRI LANKA

SECOND YEAR SECOND SEMESTER EXAMINATION IN SCIENCE

2008/2009 (Sept. / Nov. 2010)

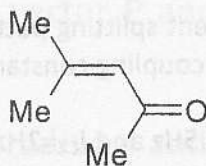
CH 203 SPECTROSCOPIC METHODS

(PROPER & REPEAT)

Answer all questions

Time: 01 hour

1. (a) Mesityl oxide has the following structure

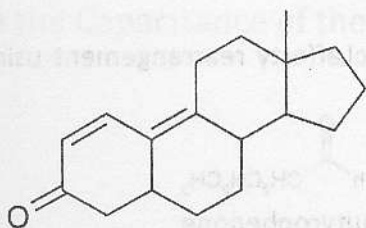


(i) Identify the chromophore and the type of electronic transitions that could be seen in the UV-Visible spectrum (10 marks)

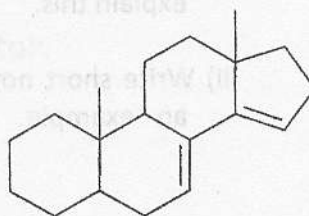
(ii) UV-Visible spectrum of mesityl oxide obtained in iso-octane shows band at  $\lambda_{\max}$  230.6 and 321nm. If the spectrum obtained in chloroform as a solvent the above bands moved to 234.6 and 314 nm respectively. Explain the above observation.

(15 marks)

(b) Calculate the  $\lambda_{\max}$  values for the following compounds using Woodward-Fieser rules.



(i)



(ii)

(40 marks)

Turn off

(c) (i) Indicate the number of vibrational degrees of freedom for a linear and a non-linear molecules. Draw the pictorial representation of the various vibrational modes for the CO<sub>2</sub> molecule.

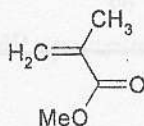
(10 marks)

(ii) The carbonyl stretching frequency of cyclohexanone is 1715cm<sup>-1</sup> where as for cyclopentanone is 1745cm<sup>-1</sup>. Explain the above observation

(10 marks)

(iii) IR spectrum of methyl methacrylate (structure shown below) shows major absorption bands at  $\nu/\text{cm}^{-1}$  3100, 2900, 1700, 1620, 1150 and 920 regions. Interpret the data to the respective vibrations of the molecule.

(15 marks)



Methyl methacrylate

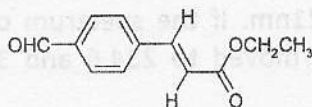
2. (a) Draw the consequent splitting pattern for a nucleus X coupling with protons A, B, and C when the coupling constants are

(i)  $J_{AX} = 10\text{Hz}$ ,  $J_{BX} = 5\text{Hz}$  and  $J_{CX} = 2\text{Hz}$

(ii)  $J_{AX} = 20\text{Hz}$ ,  $J_{BX} = 10\text{Hz}$  and  $J_{CX} = 5\text{Hz}$

(25 marks)

(b) Sketch the <sup>1</sup>H-NMR spectrum of the following compound with complete labelling. Indicate the approximate chemical shift values and the coupling constants of the various coupled protons of the compound.

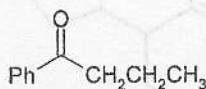


(30 marks)

(c) (i) Mass spectrum of 2-pentanol shows peaks at  $m/z$  73, 70, 55, 45 and 42. (Molecular ion peak absent). Write the fragmentation mechanism to explain this.

(30 marks)

(ii) Write short notes on McLafferty rearrangement using butyrophenone as an example.



Butyrophenone

(15 marks)