



NATIONAL OPEN UNIVERSITY OF NIGERIA

14/16, Ahmadu Bello Way, Victoria Island

SCHOOL OF SCIENCE AND TECHNOLOGY
October, 2013 Examination

COURSE CODE: CHM309

COURSE TITLE: ORGANIC SPECTROSCOPY

INSTRUCTION: ATTEMPT ANY FOUR QUESTIONS

TIME: 2HOURS

1. (a) Discuss the instrumentation in UV/Vis spectroscopy.
(4½ marks)
(b) List the factors governing the absorption of radiation in the UV/Vis region
(4 marks)
(c) Calculate the concentration of the solution of compound X, in mol dm^{-3} , if the concentration of a solution of the compound X is $2.4 \times 10^{-2} \text{ mg cm}^{-3}$, and the molar mass of X is 120 g mol^{-1} ?
(4 marks)
(d) Calculate the absorbance at λ_{max} 263nm, if the molar absorptivity (ϵ), of the molecule with concentration $9.54 \times 10^{-5} \text{ mol dm}^{-3}$ is $13102.73 \text{ dm}^{-3} \text{ mol}^{-1} \text{ cm}^{-1}$.
(4 marks)
2. (a) Two organic compounds X and Y both have absorption maxima at 255 nm and 330 nm. For a pure solution of X, $\epsilon(255) = 4.60$; $\epsilon(330) = 0.46$. Also for a pure solution of Y, $\epsilon(255) = 3.88$; $\epsilon(330) = 30.0$. For a mixture of X and Y in a 0.01m cell, $A(255) = 0.274$ and $A(330) = 0.111$. Calculate the concentrations of X and Y in the mixture.
(8½ marks)
(b) List two applications of UV/Vis spectroscopy.
(4 marks)
(c) Discuss the factors determining the intensity and energy level of absorption in IR Spectroscopy. (5 marks)
3. (a) Describe the Infra-red Spectrum.
(5½ marks)
(b) List the uses of Infra-red Spectroscopy
(6 marks)
(c) Explain one of the uses listed in 3b above in details.
(6 marks)
4. (a) Explain the principles of Mass Spectroscopy.
(6½ marks)

- (b) What is a molecular ion?
(2½ marks)
 - (c) What is the base peak?
(2½ marks)
 - (d) Discuss Chemical Ionization in mass spectroscopy.
(6½ marks)
5. (a) Choose any five functional groups and explain their fragmentation patterns.
(10 marks)
- (b) What is GC-MS
(3½ marks)
 - (c) Discuss the ionization techniques used in GC-MS.
(4 marks)
6. (a) Highlight the main components of a typical NMR spectrometer.
(8 marks)
- (b) Explain the general guideline to ^1H -NMR spectra interpretation.
(9½ marks)