



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE

SCH 501: ADVANCED ANALYTICAL INSTRUMENTATION

DATE: THURSDAY, 29TH MARCH 2012

TIME: 9.00 A.M. – 12.00 P.M.

INSTRUCTIONS: Answer All the questions.

1.
 - (a) Briefly explain the main principles of optical spectroscopy and how these principles are used in analytical chemistry. (5 marks)
 - (b) Draw a schematic diagram of an optical instrument and indicate the role of each part. (6 marks)
 - (c) Differentiate between the following terms:
 - (i) Chromophore and auxochrome
 - (ii) Fluorescence and phosphorescence
 - (iii) Stoke and antistoke radiation(5 marks)
 - (d) It is advisable not operate the hollow cathode above the maximum allowed current, Why? Use of high current in hollow cathode during atomic absorption analysis can be used in certain situations. Explain? (4 marks)
2.
 - (a) Briefly explain how a Rowland circle is used in emission spectroscopy. Use a diagram to illustrate your answer. (4 marks)
 - (b) Compare and contrast flame atomization and electro thermal atomization. (4 marks)
 - (c) Explain how direct current plasma sources works. (4 marks)
 - (d) You are given a solid sample containing unknown metals. Explain a procedure you will carry out to determine the metals present and their concentration. (5 marks)

3. (a) A solution containing 2.5×10^{-3} M of compound Y had transmittance of 12.8% when measured in a 2 cm cell, using UV/visible instrument at a wavelength of 220 nm. What is the molar absorptivity of Y? Another solution of Y had a transmittance of 50% under the same conditions. What was the concentration of Y in this solution. (5 marks)
- (b) Under what conditions can two ionization sources be used in mass spectrometry? Give two ionization sources that can be combined and the information obtained. (4 marks)
- (c) Explain two ways of simplifying complex carbon 13 NMR spectra. (4 marks)
- (d) Indicate the types of protons and their multiplicity in following organic compounds.
- i) $\text{CH}_3\text{CHOHCH}_2\text{CH}_2\text{OH}$
- ii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$ (4 marks)
4. (a) Why is it important to maintain constant magnetic field during NMR analysis? Explain two ways of maintaining constant magnetic field in NMR. (4 marks)
- (b) The IR spectrum of CO shows a vibration absorption peak at 1270 cm^{-1} . What is the force constant for the CO bond? Note AMU for C = 12, and for O = 16. The speed of light = $3.0 \times 10^{10} \text{ cm/s}$. (4 marks)
- (c) Explain how time of flight mass analyzer works. How does it differ from quadrupole mass analyzer? (4 marks)
- (d) An interference filter is to be constructed to isolate a sodium line at 589.90 nm. If the determination is to be based upon first order interference, how thick should the dielectric layer be if its refractive index is 1.34. (4 marks)
