



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

INSTITUTIONAL BASED PROGRAMME (IBP) – DECEMBER SESSION

EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE

SCH 557: SPECIAL ANALYTICAL TECHNIQUES

DATE: Friday, 29th April, 2011

TIME: 9.00 a.m. – 12.00 p.m.

INSTRUCTIONS:

Answer **ALL** questions.

- Q.1 a) Explain the difference between the following:-
- i) ISS and SIMS techniques used in surface analysis
 - ii) DTA and DSC as thermal techniques
 - iii) Raman scattering and IR spectroscopy techniques
 - iv) Turbidimetry and nephelometry techniques
- (12 marks)
- b) Electron spectroscopy involves a signal consisting of a beam of electrons. Using diagrams describe the basis of the techniques involved and explain how they are use in analysis. (10 marks)
- c) Draw a schematic diagram of a polarimeter and discuss its main parts. (6 marks)
- Q.2 a) Radiochemical techniques are commonly used in routine analysis.
- i) Describe the decay process that takes place in a nucleus with low neutron to proton ratio.
 - ii) Define isotope dilution analysis and discuss how the technique is used to study the presence of an amino acid in a food material

- iii) In the determination of glycine from a food material, 0.50g of tagged glycine, with a specific activity of 25000 counts per minute (cpm) was added and mixed thoroughly. From the mixture 0.20g of pure glycine was obtained and had activity of 1250 counts per 10 minutes. The background activity was 100 counts per five minutes. Calculate the amount of glycine in the food material.

(10 marks)

- b) Write short notes in the following topics.

- i) Electron scanning microscopy
- ii) Scintillation counters
- iii) Dispersion analyzer

(12 marks)

- Q.3 a) Explain how photoacoustic spectroscopy can be used analyse a blood sample. (5 marks)

- b) A Master of Science student determined the amount of calcium and barium ions in a clay soil using thermogravimetric technique. He dissolved 0.6025g to precipitate the ions as $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and $\text{BaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$. The oxalates were then heated in a thermometric apparatus up to 700°C leaving a residue that weighed 0.5713g in the range $320 - 400^\circ\text{C}$ and 0.4673g in the range of $580 - 620^\circ\text{C}$.

- i) Explain the changes taking place in the sample during heating.
- ii) Draw a thermogram that can be obtained if the sample was heated up to 1000°C
- iii) Calculate the percentage weight of the ions in the soil. [Ba = 137, Ca = 40, C = 12, O = 16, H = 1] (10 marks)

- c) Explain what you understand by circular dichroism (CD) and optical rotatory dispersion (ORD) (5 marks)