



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE
(ANALYTICAL CHEMISTRY)

SCH 418: NON-SPECTROSCOPIC TECHNIQUES

DATE: FRIDAY, 2ND DECEMBER 2011

TIME: 2.00 P.M. – 4.00 P.M.

INSTRUCTIONS: Answer ALL Questions

- Q1 a) Differential analysis (DTA) and differential scanning calorimetry (DSC) are similar techniques.
- (i) Explain the differences in the two techniques
- (ii) Discuss the types of peaks and their meaning produce in a thermogram.
- (iii) Draw resultant differential thermal analysis thermogram of a polyethylene material when heated to high temperatures and identify the peaks produced
- [10 marks]
- (b) (i) Draw a thermogram produced when calcium oxalate monohydrate sample is heated to 1000°C in the normal and inert atmospheres.
- (ii) A sample of mixed calcium oxalate monohydrate and silica weighed 7.02g. After heating to 800°C in a thermal analysis procedure, the mixture weighed 6.56g. Calculate the weight of calcium oxalate monohydrate in the original sample? [M.Wt. Calcium oxalate monohydrate = 146g, CaO = 56g]
- [10 marks]
- c) Discuss the experimental factors that affect thermogravimetric analysis. [5 marks]
- Q2 a) Analysis using radiochemical techniques depends upon the radioactivity of the solute.
- (i) Describe the particles/radiation emitted from a radionuclide.
- (ii) Explain the nature of decay experienced when the neutron to proton ratio of the nucleus is high.

[6 marks]

- b) Activation analysis involves bombarding the sample with energetic particles carried out.
- (i) Write a resultant nuclear reaction from interaction.
 - (ii) Explain the process of using activation analysis in quantitative analysis.
 - (iii) 10 mg of a labelled analyte, with specific activity of 18870cpm was added to the mixture analysed. After thorough mixing, 1.5mg of the pure analyte was separated and its specific activity was found to be 1550cpm. What was the amount of the analyte in the original sample?

[8 marks]

- c) Using a diagram explain how a scintillation counter works.

[6 marks]

- Q3 a) A chemist student analyzed copper ions in a water sample using a polarographic procedure.

- (i) Draw a labeled polarogram the student obtained
- (ii) Explain the difference between limiting and diffusion current
- (iii) Discuss the advantages of using a dropping mercury electrode in polarography

[10 marks]

- b) Potentiometric techniques are a direct application of the Nernst equation.

- (i) Write the equation and state under what condition it applies
- (ii) The ion selective electrodes usually contain an internal reference electrode. Using a diagram explain the functioning of a calomel reference electrode.
- (iii) Discuss the interference experienced when using ion selective electrodes.

[10 marks]

- c) Define the term differential pulse polarography.

[5 marks]
