



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

INSTITUTIONAL BASED PROGRAMME (IBP) (AUGUST SESSION)

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 404: INSTRUMENTAL METHODS

DATE: Tuesday 3rd January 2012

TIME: 11.00a.m – 1.00p.m

INSTRUCTION: Answer **All** questions.

Question One

a) Briefly define the terms below:-

- i) Voltametry
- ii) Half life of a radio isotope
- iii) Aspiration in AAS technique
- iv) Column effluent
- v) Calibration

(5 Marks)

b) State the main difference between the following:-

- i) Chromatogram and thermogram
- ii) Source of excitation in absorption and emission processes
- iii) Spectrum in IR and Uv-Vis spectroscopy
- iv) NMR and atomic absorption with reference to the 'atom'
- v) Components of MS and absorption techniques

(10 Marks)

c) Glycine (0.50g) with specific activity of 2500 cpm was added to an unknown sample.

After mixing, 0.20 g of pure glycine was obtained with an activity of 1250 cpm. The background activity was 100 cpm. How many grams of glycine were in the sample?

(5 Marks)

Question Two

- a) For each of the following, state any two:-
- i) Advantages of mass spectroscopy
 - ii) Non-radiative relaxation process in NMR.
 - iii) Factors affecting thermal analysis
 - iv) Steps in planar chromatography
 - v) Radioactive detectors
 - vi) Regions of IR spectroscopy
 - vii) Properties of solvents for Uv-Vis spectroscopy
 - viii) Advantage of a dropping mercury electrode (8 Marks)
- b) The printout from an HPLC equipment is called a chromatogram.
- i) Sketch a chromatogram to show good peak resolution and increasing concentration for three solutes (4 Marks)
 - ii) State the difference in mode of separation between HPLC and GLC. (1 Mark)
 - iii) Calculate the plate height for a compound separated on a 30 cm long HPLC column with retention time of 5.07 mins and peak base of 0.88 mins. (3 Marks)
 - iv) Explain the working of a UV-detector used in HPLC. (3 Marks)
- c) Which step of analysis employs the use of instrumental methods? (1 Mark)

Question Three

- a) To quantitatively analyze in Uv-visible spectroscopy, the Beer's Law is employed.
- i) Express the law and define its terms (3 Marks)
 - ii) Hence calculate the concentration of an analyte in a 2.5 cm cell with a transmittance of 8.42% (Molar absorptivity = 2100 L/mol/cm). (5 Marks)
 - iii) Draw a diagram of a monochromator and state its purpose in the Uv-Vis instrument (4 Marks)
- b) Describe the principle of a technique that can be used to determine the suitability of a rubber product. (3 Marks)
- c) Name a detector that can be employed both in absorption and radiochemical techniques (1 Mark)

Question Four

a) Give a brief reason for each of the following:

- i) The magnitude of current in a photomultiplier tube is magnified more than in a phototube
- ii) Thermal detectors are employed in IR spectroscopy.
- iii) Spraying a locating reagent on a developed TLC plate.
- iv) Cl_2 does not absorb IR radiation.
- v) Atomization by electrothermal atomizer rather than using a flame
- vi) Placing the wave length selector between source and sample. (6 Marks)

b) Sketch and describe the working of a hollow cathode lamp. (5 Marks).

c) Describe the process of fragmentation of a molecule ABC using an electron impact source (include equations). (5 Marks)

