MURANG'A UNIVERSITY COLLEGE

(A Constituent College of Jomo Kenyatta University of Agriculture and Technology)

School of Pure and Applied sciences

Diploma in Analytical chemistry

Unit title: Instrumental methods of analysis

Unit code: ASC1304

AS/CHEM/13D

Date: 24th JULY 2015 **Time: 3hrs**

Answer ALL questions

SECTION A

1 a) Define derivatization as used in GLC (1 mks)

b) Give the THREE reasons for derivatization in GLC (3 mks)

2. Describe the process that lead to the production of analytical signal in flame photometry. (4 mks)

4. List four characteristics of the mobile liquid phase used in HPLC. (4mks)

5. (a) Explain why monochromatic radiation is not used in I.R spectroscopy (3 mks)

(b) State the function of a monochromator in an infra red spectrophotometer (1 mk)

6. Describe methods for sampling solids for infra red analysis (4 mks)

7. List four parameters which must be optimized before using an AAS for analysis. (4 mks

8. List four requirements for the pumps used in high performance liquid chromatography. (4 mks).

9.Differentiate between a Chromophores and a chromogen as used in UV –visible spectrophotometry and in each case give an example. (4 mks)

10. List four physical interferences that cause deviation from Beer-Lamberts Law in atomic absorption spectrophotometry. (4 mks)

SECTION B

11 (a) (i) Explain the meaning of "finger print region" as used in I.R spectroscopy. (3 mks)

(ii) Describe the characteristics of the finger print region of the I.R spectrum. (3 mks)

b) State four

i) Limitation of I.R spectroscopy as a method of analysis (2 mks)

ii) Application of I.R spectroscopy in industry (2 mks)

c).substance A and B have retention time of 16.40 and 17.63 minutes respectively, on 30.0cm column. An unretained species passes the column in 1.30minutes the peak widths for A and B are 1.11 and 1.21 minutes respectively.

Calculate

(i) The column resolution, (1 mk)

(ii) Average number of theoretical plates

(iii) The plate height (2 mks)

(iv) Length of column required to achieve a resolution of 1.5 (2 mks)

(v) The time required to elute substance B on the longer column (Give comment on the answer) (2marks)

12. a) A serum sample is analyzed for potassium by frame emission spectroscopy using the method of standard additions. Two $0.5cm^3$ aliquot are added each to $5cm^3$ portions of water. To one portion is added $0.01cm^3$ of 0.05M KCl solution. The net emission signals in arbitrary units are 32.1 and 58.6 determine the concentration of potassium in the serum sample. (4mks)

b. State Two causes of deviation from Beer Lambert law in

i) AAS

ii) UV spectrophotometry. (4mks)

c). A 20ppm solution of copper gives an AAS signal of 15.0 percent transmittance.

Calculate the sensitivity of the instrument for copper. (Cu = 64) (4 mks)

d). State two advantages of the standard addition method over the over the internal standard method. (4 mks)

e)State four disadvantages of gas liquid chromatography as a separation method (4 mks)

13a). Distinguish between laminar flow burner and total consumption burner (2 mks)

b). Sketch a graph to show the effect of high concentration on the Beer-Lambert's law.

(2 mks)

c) Strontium can be determined in Portland cement if the emission at 461 µm is corrected by subtracting the emission at 466 µm. the following corrected meter reading were obtained using known solution

Sr ppm	Meter reading
100	70
80	64
60	55
40	44
20	32
10	21
0	0

I) plot a graph of meter reading against strontium concentration (6 mks)

ii) Calculate the concentration of solution that has a reading 50%. (2 mks)

(b) Sketch the Van Deemter graph and explain the parts (8mks)