LAIKIPIA UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2023/2024 ACADEMIC YEAR

THIRD YEAR EXAMINATION FOR THE DEGREES OF BACHELOR OF SCIENCE (GENERAL) AND BACHELOR OF EDUCATION (SCIENCE)

CHEM 324: INSTRUMENTAL ANALYSIS I

STREAM: R ***TIME: 2 HRS***

DAY: TUESDAY[8.30AM-10.30AM] ***DATE: 09/04/2024***

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

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INSTRUCTIONS:

Attempt **All** Questions

QUESTION ONE (30 MARKS)

a) Discuss classical analytical methods used for quantitative measurement **(4 Marks)**

b) Outline the difference between

i) an analytical technique and an analytical method **(2 Marks)**

ii) procedure and protocol of an analysis **(2 Marks)**

c) What is meant by the term

i) Method Validation **(1 Mark)**

ii) Quality assurance **(1 Mark)**

d) Discuss data domains in instrumental analysis **(5 Marks)**

e) Define the following terms **(3 Marks)**

i) Transducer

ii) Sensor

iii) Detector

f) i) Define the term Noise **(1 Mark)**

ii) State the usefulness of Signal to Noise ratio (S/N) **(1 Mark)**

iii) The pH of an aqueous sample was measured repeatatively to give the following measurements: 7.034, 7.047, 7.012, 7.041, 7.026, 7.038; Calculate the S/N for the set of measurements **(4 Marks)**

iv) Discuss the methods of enhancing signals to noise ratio in instrumental analysis (**4 Marks)**

g) Outline the areas of advancement that continue to mark the future of modern instrumentation **(2 Marks)**

QUESTION TWO (20 MARKS)

a) i) Define the term calibration (**1 Mark)**

ii) Discuss External standard, standard addition and internal standard calibration methods **(6 Marks)**

b) i) What is meant by a figure of merit (FOM)? **(1 Mark)**

ii) Explain the six figures of merit in analytical chemistry **(6 Marks)**

c) A least squares analysis of calibration data for the determination of lead based on its flame emission spectrum yielded the equation $S = 1.12C_{Pb} + 0.312$; C_{Pb} is the lead concentration in ppm and S is the measure of relative intensity of the lead emission line.

Concentration (ppm Pb)	Number of replications	Mean Value of S	s
10.0	10	11.62	0.15
1.00	10	1.12	0.025
0.000	24	0.0296	0.0082

Calculate;

i) Calibration sensitivity **(1 Mark)**

ii) The analytical sensitivity at 1 and 10ppm **(3 Marks)**

iii) the detection limit **(2 Marks)**

QUESTION THREE (20 MARKS)

a) i) Give a summary of the steps in a method of Chemical analysis (**6 Marks)**

ii) Outline the common factors to be considered by an analyst when defining the problem. **(4 Marks)**

b) i) State the basic function of instrumentation and discuss the flow of information in an instrumental measurement **(5 Marks)**

ii) Give an analysis of the future of modern instrumentation by highlighting trends in atleast three areas **(5 Marks)**