



MAASAI MARA UNIVERSITY

**REGULAR UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER**

**SCHOOL OF PURE APPLIED AND HEALTH
SCIENCES
BACHELOR OF SCIENCE (CHEMISTRY)**

**COURSE CODE: CHE 3119-1
COURSE TITLE : ANALYTICAL CHEMISTRY III**

DATE: 7/12/2023

TIME: 0830-1030 HRS

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED.

**ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO
QUESTIONS.**

QUESTION ONE (THIRTY MARKS)

- a. Define the following instrumental parameters **(4 Marks)**
- i. Filtering
 - ii. Signal
 - iii. Smoothing
 - iv. Noise

b. As a quality manager in a manufacturing industry, you are tasked with a responsibility of buying an electrical transducer. Outline four parameters you will consider before purchasing the transducer **(2Marks)**

c. *Figure 1* below shows General Flow of an Instrument. Use it to answer the following questions.

- i) Identify the parts labelled A,B,C and D **(2Marks)**
- ii) Outline the functions of the parts labelled in c i) above **(4Marks)**

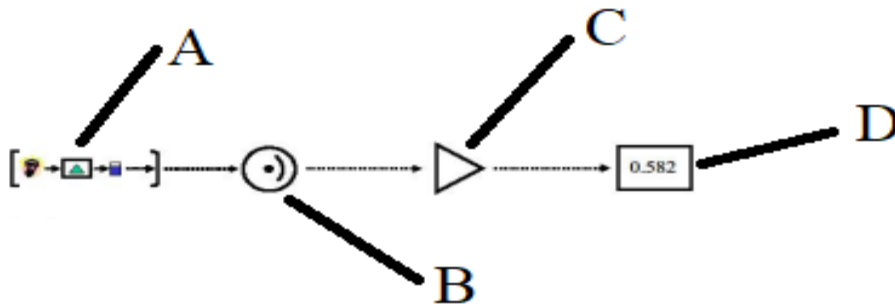


Figure 1

- d. By use of diagram, explain the difference between flame atomization and graphite furnace atomization in atomic absorption spectroscopy. **(2Marks)**
- e. Software support is an integral part of modern instrumentation. Identify three major classes of software in instrumentation system and give examples in each case **(3Marks)**
- f. Calculate Signal to Noise Ratio for the audio signal series (50, 30, 20, 35, and 25). **(2Marks)**
- g. State the applications of the following analytical instruments **(4Marks)**

- i. Scanning Electron Microscopy
- ii. X-ray emission spectrometry
- iii. Mass spectrometry
- iv. Fourier Transform Infrared

QUESTION TWO (15 MARKS)

- a. Explain the working principle of Mass spectroscopy (MS) **(3Marks)**
- b. Give four differences between reverse phase HPLC and normal phase HPLC **(2Marks)**
- c. The total concentration of heavy metals was analyzed in water in a Village in Suswa. Prior to the sample readings, the instrumental calibrations results were tabulated

Concentrations(p pm)	0	2	4	6	8	10	12	14	16	18	20
Detector signals	2.1	5	9	12.6	17.3	21	24.7	28.4	31.0	32.9	33.9

- i. Using the above information, construct calibration curve **(5Marks)**
- d. Another researcher validated the method by spiking a blank using a standard of concentration 10ppm in triplicate. The researcher analyzed the spiked samples and obtained 9.4ppm, 9.8ppm and 9.6ppm.
 - i. Calculate recovery **(2Marks)**
 - ii. Using the results from the graph, calculate the limit of detection and limit of quantification **(3Marks)**

QUESTION THREE (15 MARKS)

- a. Outline four differences between Raman and IR spectra **(2Marks)**
- b. Define the term detector **(1Marks)**
 - i. State and explain four types of HPLC detectors **(4Marks)**
- c. **Figure.2** below shows a schematic diagram of an analytical instrument. Use it to answer the following questions
 - i. Name the analytical instrument **(1Mark)**
 - ii. Name the parts labelled A,B,C,D,E,F,G and H **(4Marks)**
 - iii. Explain the working principle of the instrument named in **c i)** above **(3Marks)**

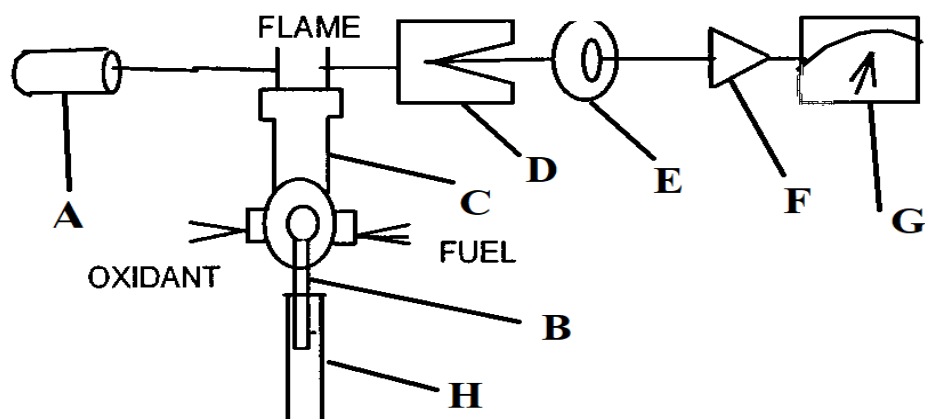


Figure 2

QUESTION FOUR (15 MARKS)

- a. Describe the different excitation sources used in spectroscopic methods of analysis. (4Marks)
- d. State and explain four sources of instrumental noise. (2Marks)
 - i. Briefly outline how each source named in **4a** above can be minimized (2Marks)
- e. Outline six basic steps of chemical analysis (3Marks)
- f. Describe the following analytical techniques
 - i. Qualitative analysis (1Mark)
 - ii. Quantitative analysis (1Mark)
 - iii. Structural analysis (1Mark)

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