



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**WEBUYE CAMPUS**

**UNIVERSITY EXAMINATIONS  
2022/2023 ACADEMIC YEAR**

**MAIN EXAMINATION**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE CHEMISTRY & EDUCATION  
SCIENCE**

**COURSE CODE: SCH 220**

**COURSE TITLE: ANALYTICAL CHEMISTRY II**

**DATE: 11/04/2023**

**TIME: 12.00 - 2.00 P.M.**

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**INSTRUCTIONS TO CANDIDATES**

Answer all the Questions

**TIME: 2 HOURS**

MMUST observes ZERO tolerance to examination  
cheating

### QUESTION ONE

- (a) Discuss the various steps in analysis of samples (3 Marks)
- b) Explain the events that take place when a sample solution is aspirated into the flame of an atomic absorption spectrometer (2 Marks)
- c. Explain the principle of operation of each the following component of an atomic absorption spectrometer:
- Hollow cathode lamp (2 Marks)
  - Nebulizer (2 Marks)
  - Atomiser (1½ Marks)
  - Monochromator (2½ Marks)
  - Photomultiplier detector (3 Marks)
- d. Explain the following terms as used in atomic spectroscopy (3 Marks)
- Self absorption
  - Modulation of hollow cathode lamp.

### QUESTION TWO

- a. Define the terms (2 Marks)
- chromatography
  - Retardation factor
- b. Give the principle of and their differences (4 Marks)
- thin layer chromatography
  - paper chromatography
- c. Distinguish between partition chromatography and adsorption chromatography as used in gas chromatography (2 Marks)
- d. Explain the following terms as used in gas chromatography (6 Marks)
- Efficiency of column
  - Resolution of peaks
  - Retention time
- e. Distinguish between the following as used in HPLC (3 Marks)
- Normal phase and reversed phase chromatography
  - Size exclusion chromatography and ion exchange chromatography
  - Isocratic and programmed elution
- f. i. What is mass spectrometry (1 mark)
- ii. Give the molecular formula of hydrocarbon cation with an m/z value of 91 (1 mark)
- iii. Give two uses of mass spectrometry (1 mark)

### QUESTION THREE

Explain the following detectors in HPLC

- a) UV/visible spectrophotometric detector (2 ½ Marks)
- b) Fluorescence detector (3 Marks)
- c) Refractive index detector (2 ½ Marks)
- d) Distinguish between the following
  - i. Fluorescence and phosphorescence (8 Marks)
  - ii. Pre filter and post filter effect
  - iii. Vibrational relaxation and internal conversion
  - iv. Triplet and singlet states

#### QUESTION FOUR

- a. Explain the following terms (3 Marks)
  - i. Quenching
  - ii. Intersystem crossing
  - iii. Quantum yield
- b. Describe the various components of a spectrofluorimeter (5 Marks)
- c. Distinguish between  $\alpha$  – and  $\beta$  –spin states (2 Marks)
- d. Explain the principal of NMR spectroscopy (4 Marks)
- e. Describe the various components of NMR spectrometer (4 Marks)