



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL
SCIENCE

UNIVERSITY EXAMINATION FOR DIPLOMA IN SCIENCE LABORATORY

1ST YEAR SEMESTER 2
2023/2024 ACADEMIC YEAR
REGULAR

COURSE CODE: SLD 1201

COURSE TITLE: CHEMISTRY TECHNIQUES 1

EXAMINATION VENUE:

EXAMINATION SESSION:

DATE OF EXAMINATION:

TIME: 2 HOURS

INSTRUCTIONS:

- 1. Answer all questions in section A and any six questions in section B**
- 2. Candidates are advised not to write on question papers**
- 3. Candidates MUST hand in their answer booklets to the invigilator while in the examination rooms**
- 4. Some important information, formulas and the periodic table may be provided on the last page of this question paper**

SECTION A

(Attempt all questions in this section)

QUESTION 1 (40 MARKS)

- a) (i) What is a science laboratory (2 mark)
- (ii) Names three groups of people who use science laboratories on regular basis (3 marks)
- (iii) With reference to basicity of chemical analytes, differentiate between concentrated and strong acids (2 marks)
- (iv) Name any two acid-base indicators commonly used in the laboratory (2 marks)
- (v) Suggest and explain any two physical properties that may be used to confirm that a water sample is pure (4 marks)
- b) (i) List three reasons why laboratory technicians should be trained and certified before placement into school science laboratories (3 marks)
- (ii) Calculate the molarity of a solution prepared by dissolving 5 grams of sodium carbonate in 100 mL of distilled water and topping up to 2 litres of solution (Na = 23.00; O = 16.00; C = 12.00; Hydrogen = 1.00) (5marks)
- c) (i) Differentiate between a sample and sampling (2 marks)
- (ii) Name any two sampling methods used in science laboratories (2 marks)
- (iii) Explain why a laboratory sample may need to be ground into fine powder before analysis is done (2 marks)
- (iv) Name any two laboratory equipment used for grinding of samples (2 marks)
- (v) Give two reasons why some laboratory samples may not be stored in open air (2 marks)
- d) Packing of hazardous analytical reagents should include the SDS.

- (i) Write SDS in full (1 mark)
 - (ii) Explain the meaning of SDS to the users of hazardous chemicals (2 marks)
 - (iii) Differentiate between dark storage and cold storage of laboratory samples (2 marks)
- e) (i) Name any two types of weighing equipment used in the science laboratories (2 marks)
- (ii) Name any two techniques used in the separation of laboratory samples (2 marks)

SECTION B (60 MARKS).

Attempt any SIX questions.

QUESTION 2: 10 MARKS

You are provided with triplicate egg-shell samples from 7 poultry farms in Siaya county. Design an experimental procedure to determine the mean percentage of calcium in the samples (10 marks)

QUESTION 3: 10 MARKS

You are the Laboratory Technician of JOOUST High School with a candidate class of 650 students. The chemistry teacher has required you to set up an experiment in which every candidate will use about 400 mL of 2M NaOH and 120 mL of sulphuric (VI) acid. Propose a detailed proposal detailing apparatus, reagents, safety precautions etc, for the efficient running of the experiment (10 marks)

QUESTION 4: 10 MARKS

You have been provided with 4 varieties of groundnuts grown at the Coastal region of Kenya. The samples are to be analysed for the determination of groundnut oil and to establish the variety with the highest quantity of groundnut oil. Write a detailed procedure for the extraction and purification of the oil (10 marks)

QUESTION 5: 10 MARKS

You have been provided with a chemical bottle with the following information:

Molecular formula: HNO_3

Molecular mass: 63.07

Specific density: 1.936 g/cm^3

Purity: 65%

Quantity: 2500 cm^3

Required: Determine the concentration of the stock solution and use it to prepare 700 mL 0.6 M solution from the stock solution (10 marks)

QUESTION 6: 10 MARKS

- What is a stock solution? (1 marks)
- You have been provided with a chemical reagent bottle with the following information:

Molecular formula: KOH

Molecular mass: 56.03

Purity: 97.42%

Quantity: 500 grams when packed

Required: Give a detailed description for the preparation of 30 litres of 3M $\text{KOH}_{(\text{aq})}$ (4 marks)

- c) Describe how gravimetric analysis may be used to accurately determine the percentage of iron in a soil sample (5 marks)

QUESTION 7: 10 MARKS

- a) Describe the basicity of the following substances: (2 marks)
- (i) $\text{H}_2\text{CO}_{3(\text{aq})}$
 - (ii) $\text{NH}_{3(\text{aq})}$
- b) Describe the pH of an analyte sample under the following chemical processes:
- (i) Dissociation (2 marks)
 - (ii) Ionization (2 marks)
- c) Describe the use of universal indicator (full range) in the determination of analyte sample pH (3 marks)

QUESTION 8: 10 MARKS

- a) Explain the meaning of the term buffer solution (1 marks)
- b) State any three characteristics of buffer solutions (3 marks)
- c) By use of a specific example, describe the preparation of a buffer solution (2marks)
- d) State and explain any two applications of buffer solutions (4 marks)

QUESTION 9: 10 MARKS

- a) What is sample separation (1 mark)
- b) Describe any three basis that determine methods of analyte sample separation (6 marks)

- c) Outline any three challenges experienced during the determination of analyte sample purity (3 marks)

QUESTION 10: 10 MARKS

- a) Differentiate between qualitative chemical analysis and gravimetric analysis of chemical samples (1 marks)
- b) Outline and explain the five steps involved in gravimetric analysis process of a chemical sample (5 marks)
- c) The table below is an extract from a 5-replicate acid-base titration experiment carried out by Rina. She recorded the following volumes of 2 molar sulphuric(VI) acid against 25 mL pipette volumes of an unknown concentration of sodium carbonate solution.

Experiment	Volume of acid used (cm ³)
1	21.55
2	18.75
3	18.80
4	18.70
5	18.75

Determine the concentration of sodium carbonate used in the experiment in grams per litre (Na = 23.0; O = 16.0; C = 12.0; H = 1.0) (4 marks)