



MACHAKOS UNIVERSITY

University Examinations 2022/2023

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR
BACHELOR OF SCIENCE (AGRICULTURAL EDUCATION AND EXTENSION)
BACHELOR OF SCIENCE (PUBLIC HEALTH)
KST 104/ HSU 101: FUNDAMENTALS OF CHEMISTRY/ APPLIED
CHEMISTRY

DATE:

TIME:

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

SECTION A

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Distinguish between the following as applied in analytical technology.
- Qualitative and Quantitative analysis (2 marks)
 - Analytes and Matrix (2 marks)
 - Selective reaction and an equivalent point (2 marks)
 - Cohesion and adhesion (2 marks)
- b) Explain how a positive test result can be identified when determining the following anions in a sample.
- Carbonate ion (1 mark)
 - Sulphide (1 mark)

- iii. Sulphate (1 mark)
 - iv. Chloride (1 mark)
 - v. Lead (II) ions (1 mark)
- c) Discuss the following properties of water
- i. a high boiling point (1 mark)
 - ii. Ice floats on water (1 mark)
 - iii. Is amphiprotic (1 mark)
 - iv. high surface tension (1 mark)
- d) Explain the Precipitation process (4 marks)
- e) Calculate the hydronium ion concentration of a solution in which the hydroxide ion concentration is $6.15 \times 10^{-2}\text{M}$. (4 marks)
- f) 50.00 ml of HCl solution required 29.71 ml of 0.01963M Ba(OH)₂ to reach an end point with Bromo crystal green indicator.
- i. Define an indicator (1 marks)
 - ii. Write the equation for the reaction (1 marks)
 - iii. Calculate the molar concentration of the HCl (3 marks)

SECTION B

QUESTION TWO (20 MARKS)

- a) Distinguish between the following
- i. Precision and Accuracy (2 marks)
 - ii. Electroanalytic and Spectroscopic methods (2 marks)
 - iii. Emulsions and Aerosols colloids (2 marks)
- b) Distinguish between the following forces giving an example of their application
- i. Intermolecular forces (2 marks)
 - ii. Intramolecular forces (2 marks)
- c) Explain how soap works in making of an emulsion (3 marks)
- d) A state variable describes the state of a system at time t , but it does not reveal how the system was put into that state.
- i. Define the first law of thermodynamics (2 marks)
 - ii. Give five examples of state variables (5 marks)

QUESTION THREE (20 MARKS)

- a) Write the Beer- Lambert law - absorbance (A) of a solution (2 marks)

- b)
- i. Distinguish between soft water and hard water. (2 marks)
 - ii. Discuss how water hardness can be removed through ion exchange resins. (2 marks)
- c) Classify classical analytical techniques and discuss each of them. (6 marks)
- d) List six analytical chemistry steps followed in chemical analysis. (3 marks)
- e) Describe the preparation of 20 L of 0.05M AgNO_3 (169.87 g/mol) from a primary standard grade solid. (5 Marks)

QUESTION FOUR (20 MARKS)

- a) Provide the reason for sampling. (2 marks)
- b) State the factors to consider when sampling. (4 marks)
- c) Give two characteristics of an ideal standard solution. (2 marks)
- d) Discuss how dipole-dipole forces of attraction are formed. (2 marks)
- e) Define a primary standard and list four examples of primary standards. (6 marks)
- f) Determine the number of grams of NaOH required to make 250 cm^3 solution of 0.025 M NaOH solution? (4 marks)

QUESTION FIVE (20 MARKS)

- a) Explain why the solubility of AgI in NaI solution is less than that in pure water. (2 marks)
- b) Give the characteristics of a good sample for analysis. (3 marks)
- c) Explain the seven stages involved in a sampling process. (7 marks)
- d) Calculate the volume of concentrated sulphuric acid required to make 5 litre of 0.5 M H_2SO_4 solution? The concentrated sulphuric acid is 98% H_2SO_4 by mass and its density is 1.84 g cm^{-3} . (5 marks)
- e) Calculate the solubility product constant for SrF_2 given the molar concentration of the saturated solution is 8.6×10^{-4} M. (3 marks)