MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
FOURTH YEAR FIRST SEMESTER

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES (SPAHS)

BACHELOR OF SCIENCE IN CHEMISTRY

COURSE CODE: CHE 4134

COURSE TITLE: ANALYTICAL CHEMISTRY IV

DATE: XX MARCH, 2022 **TIME: XX - YY HRS**

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **TWO** questions in section **B**
2. No writing on the Question paper
3. Use of mobile phone in the exam room is prohibited

QUESTION ONE **[30 MARKS]**

a) Define the following terms;

i. Polarography **[1 mark]**

ii. Voltammetry **[1 mark]**

iii. Triple point **[1 mark]**

iv. Electrophoresis **[1 mark]**

b) Why is a dropping mercury electrode preferred during polarography? **[3 marks]**

c) Briefly describe the following types of current experienced during polarography;

i. Limiting current **[1 mark]**

ii. Residual current **[1 mark]**

iii. Diffusion current **[1 mark]**

iv. Migration current **[1 mark]**

d) Draw the working set-up used during ampereometry briefly describing the role of all the electrodes used **[4 marks]**

e) Use relevant examples and graphs to illustrate the four main types of conductometric titrations **[8 marks]**

f) Explain the working principle of;

i. Fluid gel chromatography **[2½ marks]**

ii. Capillary zone electrophoresis **[2½ marks]**

g) State the Ilkovic equation describing each variable used **[2 marks]**

QUESTION TWO [20 MARKS]

a) How do the potential ranges of a dropping mercury electrode (DME) compare to that of a saturated calomel electrode (SCE)? **[2 marks]**

b) State two conditions necessary for ampereometric experiments **[2 marks]**

c) Differentiate the following terms;

i. Polarizable from non-polarizable electrode **[2 marks]**

ii. Reducible from a non-reducible ion **[2 marks]**

d) The rotating platinum micro-electrode is used during polarographic titrations;

i. Why is it made to rotate **[1 mark]**

ii. Why platinum is used **[1 mark]**

e) Highlight any three merits of the rotating platinum micro-electrode **[3 marks]**

f) Using graphs and necessary examples to describe any three types of ampereometric titrations **[6 marks]**

g) What do you understand by the term biamperometry? **[1 marks]**

QUESTION THREE [20 MARKS]

Using flow chart diagrams and output graphs, explain the working mechanisms of;

a) Polarography **[5 marks]**

b) Supercritical fluid chromatography **[5 marks]**

c) Capillary zone electrophoresis **[5 marks]**

d) Micellar electrokinetic chromatography **[5 marks]**

QUESTION FOUR [20 MARKS]

a) What is the major working principle of any chromatographic method? **[2 marks]**

b) State any three types of detectors used in liquid chromatography **[2 marks]**

c) Explain the working mechanisms of the following voltammetric methods using voltammograms;

i. Linear sweep voltammetry **[4 marks]**

ii. Square wave voltammetry **[4 marks]**

iii. Anodic stripping voltammetry **[4 marks]**

iv. Cyclic voltammetry **[4 marks]**