Ser. No. EDU 045/17

GARISSA UNIVERSITY

UNIVERSITY EXAMINATION 2017/2018 ACADEMIC YEAR TWO FIRST SEMESTER EXAMINATION

SCHOOL OF EDUCATION, ARTS AND SOCIAL SCIENCES

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS)

COURSE CODE: CHE 211

COURSE TITLE: BASIC ANALYTICAL CHEMISTRY

EXAMINATION DURATION: 3 HOURS

DATE: 01/12/17 **TIME: 09.00-12.00 PM**

INSTRUCTION TO CANDIDATES

- **The examination has SIX (6) questions**
- **Question ONE (1) is COMPULSORY**
- **Choose any other THREE (3) questions from the remaining FIVE (5) questions**
- **Use sketch diagrams to illustrate your answer whenever necessary**
- **Do not carry mobile phones or any other written materials in examination room**
- **Do not write on this paper**

This paper consists of FOUR (4) printed pages ***please turn over***

QUESTION ONE (COMPULSORY)

(a) State and Explain briefly **Four** fields of applications of Analytical Chemistry **[8 marks]**

(b) What is the primary ionization technique in the following Analytical instruments **[6 marks]**

i. GC-MS

ii. LC-MS

iii. ICP-MS

(c) State any three electrochemical analytical techniques **[3 marks]**

(d) 25 cm^3 of a solution of sodium hydroxide reacts with 15 cm^3 of 0.1 mol/dm^3 HCl. What is the molar concentration of the sodium hydroxide solution **[6 marks]**

(e) Differentiate between Determinate (systematic) and indeterminate (random) errors in analytical analysis **[2 marks]**

QUESTION TWO

(a) Describe the following terms and state their acceptable values in a set of analytical analysis data **[3 marks]**

i. LOD

ii. LOQ

(b) Describe the basic steps to be followed in a chemical analysis in Analytical Chemistry **[3 marks]**

(c) Which technique can be used to separate a soluble solid from the liquid it is dissolved in **[1 mark]**

(d) State four desirable properties of standard solutions for Chemical Analysis **[2 marks]**

(f) Define the following terms as used in analytical chemistry **[2 marks]**

i. Precision

ii. Accuracy

(g) State the three types of chromatography and give their main features **[4 marks]**

QUESTION THREE

(a) Name two extraction techniques of liquid- liquid mixtures **[1 mark]**

(b) Differentiate between **[4 marks]**

i. Qualitative analysis

ii. Quantitative analysis

(c) What is the most commonly used stationary phase in reversed phase (RP) HPLC? Give the specific name **[2 marks]**

(d) What is the most commonly used stationary phase in gas-liquid chromatography GLC? Specify name **[2 marks]**

(e) Which technique can be used to separate an insoluble solid from a liquid **[2 marks]**

(f) Name 4 Important requirements expected of primary standards **[4 marks]**

QUESTION FOUR

(a) Describe the following terms as used in statistical management of analytical data **[3 marks]**

i. Average

ii. Standard deviation and Variance

iii. Relative standard deviation

(b) Five measurements of fasting serum glucose concentration were made on the same sample taken from a diabetic patient. The values obtained were 2.3, 2.5, 2.2, 2.6 and 2.5 mM Calculate the following from the data set

i. Mode **[1 mark]**

ii. Median **[1 mark]**

iii. Mean **[1 mark]**

iv. standard Deviation **[3 marks]**

v. Variance **[2 marks]**

(c) Calculate the confidence Interval at 68.3%, 95.5% and 99.7% confidence levels of fasting serum glucose concentration given in question (4,b) above (4 marks)

QUESTION FIVE

(a) Two students titrated a 100.00 mL sample of HCl with an unknown concentration with a standardized 0.1339 M NaOH sample.

$$HCl + NaOH \rightleftharpoons NaCl + H_2O$$

The students obtained the following results:

Student A: 23.17 mL, 22.69 mL, 23.25 mL, 22.97 m

Student B: 25.25 mL, 25.19 mL, 25.23 mL, 25.23 mL

i. Determine the average (mean) and standard deviation for each student's data set **[5 marks]**

ii. Which student was more precise? Explain **[2 marks]**

iii. If the unknown HCl sample has a concentration of 0.0030 M, which student is more accurate **[2 marks]**

iv. Are the results (titration volumes) obtained by the two students significantly different at the 95% confidence level (Given: $S_{pooled} = 0.18$ **[3 marks]**

v. Using the Q test, decide if the second measurement (22.69 mL) for student A should be discarded **[3 marks]**

QUESTION SIX

The aluminum (Mol. Wt =26.98 g/mole) in a 1.200g sample of impure ammonium aluminum sulfate was precipitated with aqueous ammonia as the hydrous $Al_2O_3 \cdot xH_2O$. The precipitate was filtered and ignited at 1000^oC to give anhydrous Al_2O_3 (Mol. Wt =101.96 g/mole) which weighed 0.1798g. Calculate the percentage of aluminum in the sample. **[15 marks]**