



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND  
TECHNOLOGY  
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES  
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF  
EDUCATION (SCIENCE)  
1<sup>ST</sup> YEAR 2<sup>ND</sup> SEMESTER 2016/17  
MAIN REGULAR**

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**COURSE CODE: SCH 104**

**COURSE TITLE: BASIC ANALYTICAL CHEMISTRY**

**EXAM VENUE:**

**STREAM: (BED SCI)**

**DATE:**

**EXAM SESSION: 2.00 – 4.00 PM**

**TIME: 2:00HRS**

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**Instructions:**

- 1. Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

## SCH 104: Basic Analytical Chemistry

### MAIN EXAMINATION

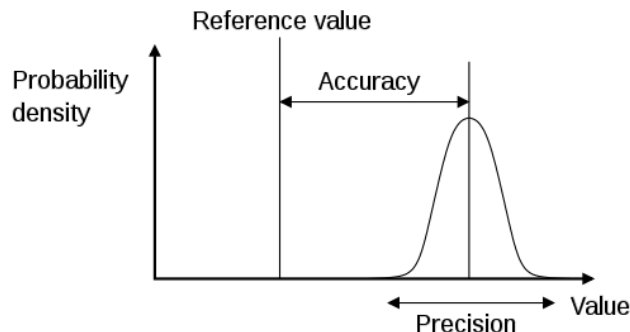
Time: 2 Hours

#### Section A

Answer All Questions in Section A

#### Question 1

- a) Analytical chemistry is the study of separation, identification and quantification of chemical components in natural and artificial materials. Briefly describe two major industrial or societal fields where the concepts of analytical chemistry can be applied. (4 marks)
- b) Define the terms:
- i. Population
  - ii. Sample
  - iii. Analyte
  - iv. qualitative analysis
  - v. quantitative analysis
  - vi. Data Analysis
- (6 mark)
- c) What are some of the wet chemistry methods employed in sample identification and quantification? (3 marks)
- d) Use the diagram below to differentiate between accuracy and precision in sample quantification. (4 marks)



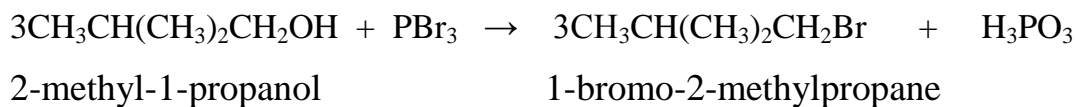
e) A measuring balance is precise to a gram. A student gave the following wrong readings. Please correct them.

- i. 12.300 g;
- ii. 0.004 g;
- iii. 120.0008 g;
- iv. 1100 g (4 marks)

f) Titanium carbide, TiC, is the hardest of the known metal carbides. It can be made by heating titanium(IV)oxide, TiO<sub>2</sub>, with carbon black to 2200 °C.  $\text{TiO}_2 + 3\text{C} \rightarrow \text{TiC} + 2\text{CO}$

- i. What is the maximum mass of titanium carbide, TiC, that can be formed from the reaction of 985 kg of titanium(IV)oxide, TiO<sub>2</sub>, with 500 kg of carbon, C? (2 marks)
- ii. Identify the reagent in excess? (2 marks)

g. Phosphorus tribromide, PBr<sub>3</sub>, can be used to add bromine atoms to alcohol molecules such as 2-methyl-1-propanol. In an experiment, 5.393 g of 1-bromo-2-methylpropane form when an excess of PBr<sub>3</sub> reacts with 6.034 g of 2-methyl-1-propanol. Determine the percent yield using the given reaction stoichiometry equation. (5 marks)



## Section B

### Answer any Two Questions

#### Question 2

Briefly describe the qualitative and/or quantitative data obtained using the following analytical instruments. Discuss the physical quantity employed by the machines. (20 marks)

- a. Flame Emission Spectrometry
- b. Atomic Fluorescence Spectrometry
- c. Visible and Ultraviolet Spectrometry
- d. Nuclear Magnetic Resonance (NMR) Spectrometry
- e. Mass Spectrometry

#### Question 3

- a. Briefly describe how you would prepare 16 ppm of Lead (II) ions in the laboratory using Lead (II) Chloride salt. (4 marks)
- b. Using examples, distinguish between the following chemical reactions
  - i. *Direct combination or synthesis*
  - ii. *Single displacement or substitution,*
  - iii. *Metathesis or double displacement reaction*
  - iv. *Acid-base reactions*
  - v. *Redox reactions*(10 marks)
- c. Water is a universal solvent and there are several reactions that take place in aqueous medium. Discuss some of the useful Chemical reactions that take place in water under the following processes.
  - i. *Dissolving Insoluble Compounds*

- ii. *Synthesis of Inorganic Compounds*
- iii. *Extraction of Metals from Solution*

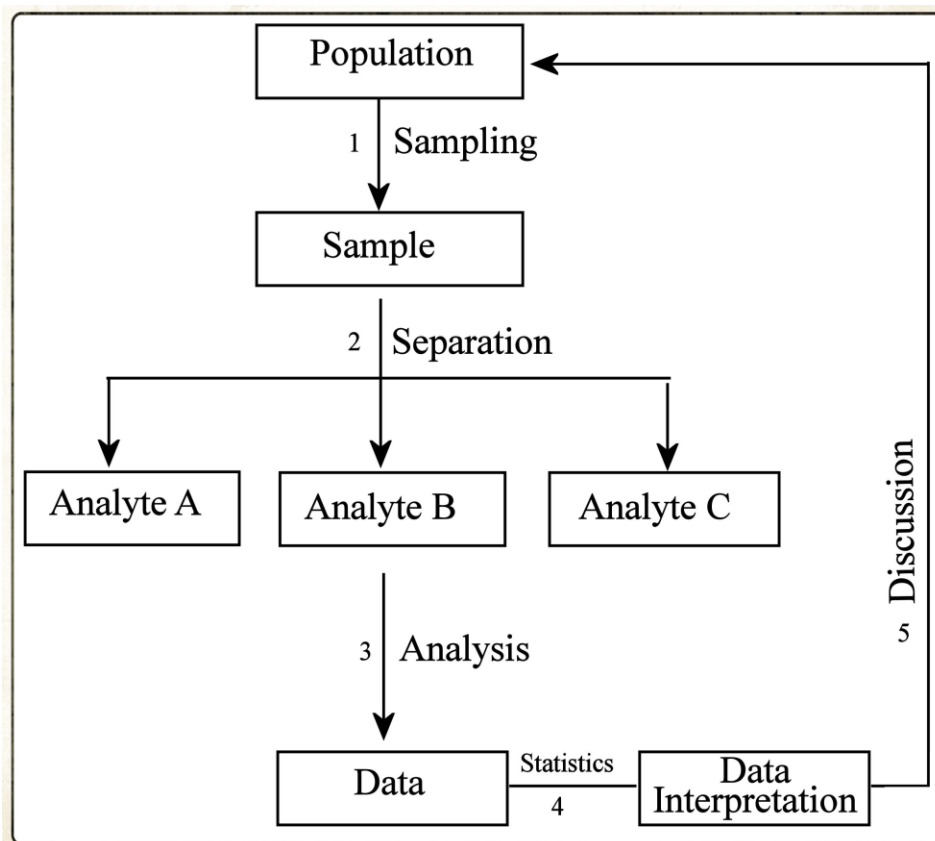
(6 marks)

**Question 4**

The diagram below shows different stages an Analytical Chemist undertakes to accomplish the task at hand. Briefly describe the stages labeled 1 to 5 under the following subtopics.

- i. Instruments
- ii. Methods
- iii. Standards

(20 marks)



### **Question 5**

Separation of a sample into different analytes and subsequent data acquisition from the analyte can be done using classical methods or instrumental methods. Briefly explain the working mechanisms of the following classical and instrumental methods.

- i. Precipitation
- ii. Solvent extraction
- iii. Titration
- iv. Column Chromatography
- v. Ultra-violet spectrometer
- vi. High Performance Liquid Chromatography
- vii. Gas Chromatography-Mass spectrometer

