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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS**

FOR THE DEGREE OF B.SC (SCIENCE)

COURSE CODE: SCH 313:

COURSE TITLE: ANALYTICAL CHEMISTRY

DURATION: 2 HOURS

DATE: 18/05/2022

TIME: 9:00AM-11:00AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 6 printed pages. Please Turn Over



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Question One (30 marks)

1.

- a) Separation and purification techniques are very important in analytical chemistry. For each of the following separation techniques state the principle behind it and applications:
- i. Filtration [03]
 - ii. Distillation [03]
 - iii. Solvent extraction [03]
- b) An analyst is required to use a primary standard, advice the analyst on the qualities of a good primary standard. [03] (3mks)
- c) Differentiate among the following terms as used in chromatography:
- i. Chromatogram [01]
 - ii. Elusion [01]
 - iii. An effluent [01]
 - iv. Retention time [01]
- d) Discuss high performance chromatography under the following subheadings:
- i. Principle [01]
 - ii. Instrumentation [04]
 - iii. Applications [02]
- e) Define the following terms as used in separation techniques [03]
- i) Sample
 - ii) Interferent
 - iii) Masking
- f) State four factors considered when choosing a suitable solvent for use in solute extraction. [04]

Question two (20 marks)

- a) What is the difference between **Extraction** and **Washing**? [02]
- b) What is **Supercritical carbon dioxide** ($s\text{CO}_2$)? Explain why it is a popular industrial solvent. [04]
- c)
- i. State "distribution law" [01]
 - ii. Why is distribution constant important? [01]
 - iii. Write an expression to show the concentration of analyte [A] remaining in the aqueous phase after several extractions. [02]
- d) The distribution constant K for Iodine between an organic solvent and water is 85. Find the concentration of Iodine remaining in the water layer after extraction of $10^{-3} \text{ mol.L}^{-1}$ iodine solution with the following quantities of organic solvent. [03]

- i) One portion of 50ml
 - ii) Two portions of 25ml
 - iii) Five portions of 10ml
- e) What are the limitations of Liquid-liquid extraction. [02]
 - f) Discuss Soxhlet extraction under the following;
 - i. Components and parts [01]
 - ii. Operation [02]
 - iii. Advantages [01]
 - iv. Applications [01]

Question three (20 marks)

- 2.
- a) Volumetric analysis is the general term for a method in quantitative analysis in which the amount of substance is determined by measurement of volume that the substance occupied. State the meaning of each of the following terms as used in volumetric analysis:
 - i. Titration [02]
 - ii. Titrant [02]
 - iii. Primary standard [02]
 - iv. Standardization [02]
 - v. Equivalent point [02]
 - b) Identify the types of volumetric analysis. [04]
 - c) Briefly discuss the applications of volumetric analysis [06]

Question four (20 marks)

What is Gravimetric Analysis? [01]

You are required to carry out precipitate analysis. Outline the steps which you will follow during this analysis [04]

Differentiate by defining, the following types of gravimetric analysis

- i. Volatilization gravimetry [01]
- ii. Precipitation gravimetry [01]
- iii. Electrogravimetry [01]
- iv. Thermogravimetry [01]

Explain the sources of error during gravimetric analysis. [03]

What are the conditions which must be fulfilled by a good precipitate for a good precipitation process? [02]

Discuss the meaning of the following terms as used in gravimetric analysis:

- i. Isomorphous inclusion [01]
- ii. Non-isomorphous inclusion [01]
- iii. Occlusion [01]
- Surface adsorption [01]

State any two applications of precipitation gravimetry. [02]