



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

ANALYTICAL III

SCH 4206

First Semester Examination Paper

December 2016

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Dr. A. Maringa

INSTRUCTIONS

- Answer ALL questions in section A and any three (3) questions in section B
- Each question in section A carries 10 marks and each question in section B carries 20 marks

Special requirements: Calculator and graph paper.

MARK ALLOCATION

QUESTION	MARKS
SECTION A: 1.	10
2.	10
3.	10
4.	10
SECTION B: 5	20
6	20
7	20
8	20
TOTAL POSSIBLE MARKS	100

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SCH 4206

SECTION A

1. (a). Distinguish between the following terms:
 - i. Acid digestion and acid dissolution. [4 marks]
 - ii. Sorbed water, Adsorbed water and Occluded water. [6 marks]

2. (a). What are the limitations of dry ashing? [4 marks]
(b). A monitoring exercise is planned for lead deposited on soil close to a busy roadway. What sampling positions would you select? [6 marks]

3. (a). Why is it better to extract with fresh solvent each time in solvent extraction? [5 marks]
(b). Describe briefly the typical procedures used for ultrasonic extraction of solids. [5 marks]

4. (a). Describe the five steps involved in solid phase extraction (SPE). [10 marks]

SECTION B

5. (a). Define the terms automation and automatic analyzer. [5 marks]
(b). Discuss the basic objectives of laboratory process automation. [15 marks]

6. You are about to take samples for the following analyses:
 - (i) Ammonia
 - (ii) Chloroform
 - (iii) Total organic content

List decisions which have to be made in developing a river sampling protocol. What are the relevant chemical and physical properties which would help you to decide on the storage conditions? In addition, suggest storage bottles and precautions to minimize analyte loss. [20 marks]

7. (a). Why is hexane on its own not a good solvent for microwave assisted extraction (MAE)? [3 marks]
- (b). A common problem for liquid-liquid extraction (LLE) is the formation of emulsions, particularly for samples that contain surfactants or fatty acids. What do you think can be done to reduce or eliminate this problem? [5 marks]
- (c). A 1 L aqueous sample containing 100 ppb of a compound having a molecular weight of 250 g/mol is extracted with 150 mL of organic extracting solvent. Assume that the K_D value is 5. Given this information, the molarity of the original sample is 4×10^{-10} M. Calculate the percent of the analyte extracted into the organic extracting solvent at equilibrium. [12 marks]
8. (a). How would you preserve aqueous samples for the analysis of total lead and sulphates? [10 marks]
- (b). Plot a calibration graph from the following data and determine the concentration of phosphorus in the sample.

Conc ($\mu\text{g/L}$)	25	50	125	250	375	unknown
Absorbance	0.058	0.149	0.370	0.683	1.060	0.426

[10 marks]

End of question paper!!!!

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