

2528/204  
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ENVIRONMENTAL ANALYTICAL TECHNIQUES  
AND LABORATORY MANAGEMENT  
June/July 2018  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY

MODULE II

ENVIRONMENTAL ANALYTICAL TECHNIQUES AND  
LABORATORY MANAGEMENT

3 hours

#### INSTRUCTIONS TO CANDIDATES

*You should have the following for this examination:*

*Answer booklet;*

*Non-programmable scientific calculator.*

*This paper consists of TWO sections: A and B.*

*Answer ALL the questions in section A and any THREE questions from section B in the answer booklet provided.*

*Each question in section A carries 4 marks while each question in section B carries 20 marks.*

*Maximum marks for each part of a question are as shown.*

*Candidates should answer the questions in English.*

**This paper consists of 4 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**



SECTION A (40 marks)

Answer ALL the questions in this section.

1. Name **four** types of funnel and crucibles used in vacuum filtration. (4 marks)
2. Outline the basic principles of steam distillation as a separation technique. (4 marks)
3. (a) Define 'sublimation'. (1 mark)  
 (b) Describe how a mixture of ammonium chloride and sodium chloride can be separated in a chemistry laboratory.  $NH_4Cl + NaCl$  (3 marks)
4. (a) State the partition law. (1 mark)  
 (b) List **three** causes of deviation from the partition law. (3 marks)
5. (a) State **two** factors that determine efficiency in column chromatography. (2 marks)  
 (b) A column of length 120 cm has 2500 theoretical plates. Calculate the plate height in this column. (2 marks)
6. Define the following terms as used in acid-base titrations:
  - (a) alkalimetry; (2 marks)
  - (b) aliquot. (2 marks)
7. (a) Define 'management'. (1 mark)  
 (b) State any **three** roles of management. (3 marks)
8. Outline the control process of management. (4 marks)
9. List **four** essentials of a good filing system. (4 marks)
10. (a) State **two** types of planning. (1 mark)  
 (b) Describe the process of receiving goods in the laboratory. (3 marks)



**SECTION B (60 marks)**

*Answer any THREE questions from this section.*

11. ✓ (a) (i) Describe the preparation of filter pulp. *Thorough maceration* (4 marks)
- (ii) Explain **two** uses of filter pulp. *Preparation of filter pulp and filter cake* (4 marks)
- (b) Draw a labelled diagram of vacuum filtration in operation. (6 marks)
- (c) State **four** advantages and **two** disadvantages of vacuum filtration as a separation method. (6 marks)
12. (a) (i) Define 'a primary standard' as used in volumetric analysis. (1 mark)
- (ii) Give **four** examples of substances used as primary standards in:
- I. alkalimetry; (2 marks)
- II. acidimetry; (2 marks)
- III. redox titrations. (4 marks)
- (b) 5.804 g of a calcium ore (limestone) was dissolved in 100 cm<sup>3</sup> of 1M HCl. The excess HCl was back-titrated with 8.3 cm<sup>3</sup> of 0.05 M NaOH to reach the phenolphthalein end-point. Determine the percentage purity of the ore (Ca=40, C=12, O=16). (11 marks)
13. ✓ (a) Explain **five** characteristics of a solvent used in solvent extraction. (10 marks)
- (b) Table I shows the results obtained in an experiment to determine the partition coefficient of ethanol acid between chloroform and water.

**Table I**

Concentration (C <sub>1</sub> ) in chloroform in mol.d <sup>-3</sup>	0.280	0.320	0.430	0.560	0.610
Concentration (C <sub>2</sub> ) in water in mol.d <sup>-3</sup>	0.012544 <i>1.25</i>	0.016384 <i>1.64</i>	0.29584 <i>2.95</i>	0.050176 <i>5.02</i>	0.05936 <i>5.95</i>

Use graphical method to determine the partition coefficient  $K_{Dc}$  of ethanol acid between chloroform and water. (10 marks)



14. (a) Distinguish between proforma invoice and quotation. (4 marks)
- (b) State any **three** disadvantages of tendering. (3 marks)
- (c) State **two** purposes of stock taking. (2 marks)
- (d) Describe the alphabetical method of filing. (11 marks)
15. (a) Explain the essential qualities of a successful manager. (8 marks)
- (b) Discuss the process of dispute resolution between the employer and employee in an organisation. (12 marks)

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