SCAN

Name _____ Index No. _____

1408/313
CHEMISTRY TECHNIQUES
June/July 2015
Time: 3 hours

Candidate's Signature _____

Date _____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN SCIENCE LABORATORY TECHNOLOGY

CHEMISTRY TECHNIQUES

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.
Sign and write the date of the examination in the spaces provided above.
You should have a Scientific Calculator (battery operated) for this examination.
*This paper consists of **TWO** Sections: **A** and **B**.*
*Answer **ALL** the questions in Section **A** and any **TWO** questions from Section **B** in the spaces provided in this questions paper.*
*Each question in Section **A** carries **4** marks while each question in Section **B** carries **20** marks.*
*Do **NOT** remove any pages from this question paper.*
Candidates should answer the questions in English.

For Examiner's use only

Section	Question	Candidate's Score	Maximum Score
A	1 - 15	60	
B		20	
		20	
	Total Score	100	

This paper consists of 20 printed pages.

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

Turn over

SECTION A: (60 marks)

*Answer **ALL** the questions in this Section in the spaces provided.*

1. State **four** properties of a wash liquid used in gravimetric analysis. (4 marks)

2. (a) Calculate the number of faradays needed to produce 4 g of magnesium when a current of 4 A is passed through molten magnesium chloride. (Mg = 24). (2 marks)

   (b) Calculate the time taken for the 4 g of magnesium to be produced in (a) above. *(IF = 96,500C).* (2 marks)

3. Outline the working principles of an acid buffer. (4 marks)

4. (a) Calculate the pH of a 0.05 M HCl. (3 marks)

(b) State the assumption made during the calculation in (a) above. (1 mark)

5. State **four** requirements of an ideal primary standard. (4 marks)

6. (a) State the Beer-Lamberts law. (2 marks)

(b) State any **two** causes of deviation from Beer-Lamberts Law. (2 marks)

7. (a) Define the term R_f value as used in chromatographic separations. (2 marks)

(b) List any **two** factors which affect R_f values. (2 marks)

8. List any **four** types of proximate analysis. (4 marks)

9. Name **four** major steps involved in gravimetric analysis. (4 marks)

10. Calculate the amount of potassium chloride needed to produce 500 ppm potassium ions in a 500 ml volumetric flask. (K = 39, Cl = 35.5). (4 marks)

11. List any **four** advantages of Thin Layer Chromatography over Paper Chromatography. (4 marks)

12. Outline the basic principles involved in steam distillation. (4 marks)

13. List any **four** methods of sample storage. (4 marks)

14. Draw a labelled diagram of gravity filtration technique. (4 marks)

15. Calculate the amount of sodium carbonate (Na_2CO_3) needed to prepare 500 cm^3 of 0.15 M solution from the pure salt. *(Na = 23, C = 12, O = 16).* (4 marks)

SECTION B: (40 marks)

*Answer any **TWO** questions from this Section in the spaces provided after question 19.*

16. (a) State the law of independent migration of ions. (2 marks)

(b) Table I below shows molar conductivity of a given electrolyte at 25°C, at different concentrations:

Table I

Concentration (mol/litre)	0.05	0.01	0.005	0.001	0.0005
Molar conductivity (s cm^2 mol^{-1})	100	107	109	112	113

(i) Convert the concentrations into dilution. (5 marks)

(ii) Plot a graph of Molar conductivity against dilution and use it to determine the Molar conductivity of the electrolyte at infinite dilution. (4 marks)

(c) The resistance of a conductance cell containing 0.1 Mol dm^{-3} potassium chloride solution at 25°C is 47.9 Ω. If the same cell contains potassium nitrate solution of concentration 0.02 Mol dm^{-3} the resistance is 254 Ω. The conductivity of the potassium chloride solution is 0.013 Ω^{-1}cm^{-1}, calculate:

(i) cell constant; (4 marks)

(ii) electrolytic conductivity of potassium nitrate; (2 marks)

(iii) Molar conductivity of potassium nitrate at given concentration. (3 marks)

17. (a) Using sketches, explain why absorbance values are preferred in calibration plots compared to % transmittance values. (4 marks)

(b) A solution containing 5 mg in 250 cm^3 of compound X had a transmittance of 36.4% in a 1 cm cell at 525 nm. If the RMM of X is 200, calculate its Molar absorptivity. (7 marks)

(c) The following data (table II) were obtained during the determination of certain drug by uv spectrophotometry.

Table II

Standard solution	**Concentration (Mol dm^{-3})**	**% T**
A	40×10^{-5}	17.9
B	32×10^{-5}	25.0
C	24×10^{-5}	35.7
D	16×10^{-5}	50.2
E	8×10^{-5}	70.8

(i) Plot a graph of absorbance against concentration. (8 marks)

(ii) Obtain the concentration of a sample of the drug whose absorbance was 0.55 in the same cell from the graph. (1 mark)

18. (a) 21.4 g of hydrated sodium carbonate $Na_2CO_3 \cdot X\ H_2O$ was dissolved in water to make up a litre of solution. 25 cm^3 of this solution required 18.7 cm^3 of 0.2 M standard hydrochloric acid for complete neutralization. Calculate the value of X.
(Na = 23, C = 12, O = 16, H = 1). (16 marks)

(b) Name **four** types of titrimetric analysis. (4 marks)

19. (a) The freezing point of pure solvent X is 30°C. Calculate the temperature at which a solution containing 2 g of oxalic acid and $(H_2C_2O_4 \cdot 2H_2O)$ per 100 g of X will freeze.
(K_f for solvent X = 5.5°C Mol^{-1}kg^{-1}, C = 12, O = 16, H = 1). (8 marks)

(b) State the distribution law. (2 marks)

(c) Describe the process of batch extractions and state why it is preferred to single stage extraction. (4 marks)

(d) The distribution coefficient for compound X between water and chloroform is 6.4. Calculate the fraction of X remaining in the water layer when 25 ml portion are shaken with:

(i) **one** 10 ml portion of chloroform; (3 marks)

(ii) **two** successive 10 ml portions of chloroform. (3 marks)