

1408/313  
CHEMISTRY TECHNIQUES  
June/July 2009  
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL  
SCIENCE LABORATORY TECHNOLOGY CRAFT  
CHEMISTRY TECHNIQUES  
3 hours

*This paper consists of TWO sections: A and B.  
Answer ALL the questions in section A and any TWO questions from section B.  
Each question in section A carries 4 marks, while each question in section B carries 20 marks.*

**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 (60 marks)

Answer ALL the questions in this section.

1. (a) Define the term "sample". (1 mark)
- (b) State the procedure of solid sample treatment before analysis. (3 marks)
2. Calculate the volume of 95% Ethanol required to prepare 100 cm<sup>3</sup> of 50% Ethanol. (4 marks)
3. State any **four** advantages of volumetric analysis over other methods. (4 marks)
4. Calculate the percentage mass of Barium in the original unknown compound if a sample of 0.6760g of unknown compound containing Barium ions (Ba<sup>2+</sup>) is dissolved in water and treated with an excess of sodium sulphate (Na<sub>2</sub>SO<sub>4</sub>). The mass of Barium sulphate (BaSO<sub>4</sub>) precipitate formed is 0.14105g. (Ba = 137, S=32, O=16, Na= 23) (4 marks)
5. Name the following complex ions:
  - (a) [Pb(Cl)<sub>4</sub>]<sup>2-</sup> (2 marks)
  - (b) [Fe(NH<sub>3</sub>)<sub>6</sub>]<sup>3+</sup> (2 marks)
6. Calculate the boiling point of a solution containing 3 g acetamide (CH<sub>3</sub>CONH<sub>2</sub>) in 100 g Ethanol. (Ebullioscopic constant = 1.15°C/m) The boiling point of ethanol is 80°C. (4 marks)
7. Calculate the volume of 0.150 moldm<sup>-3</sup> Sodium Oxalate (Na<sub>2</sub>C<sub>2</sub>O<sub>4</sub>), that will be oxidised by 25.0 cm<sup>3</sup> of 0.200 moldm<sup>-3</sup> potassium manganate VII (KMnO<sub>4</sub>) in acid solution. (KMnO<sub>4</sub> reacts with Na<sub>2</sub>C<sub>2</sub>O<sub>4</sub> in the ratio of 2:5). (4 marks)
8. Outline the determination of Nitrogen free extract in maize. (4 marks)
9. (a) Define the term "buffer". (2 marks)
- (b) State the components of a buffer solution. (2 marks)
10. Calculate the amount of Iodine extracted by 50 cm<sup>3</sup> of tetrachloromethane (an organic liquid) which was shaken with a solution containing 1 g Iodine dissolved in 25cm<sup>3</sup> of Potassium Iodide Solution. (partition coefficient is 85). (4 marks)

11. Calculate the molar mass of copper given that, in electrolysis of copper sulphate solution, a current of 0.750A deposits 0.369 g of copper in 25 minutes. (4 marks)
12. Calculate the concentration of an organic compound in grammes per litre with a relative molecular mass of 110, molar absorptivity ( $\epsilon$ ) of  $10,000 \text{ cm}^{-1}\text{mol}^{-1} \text{ L}$  and with an Absorbance (A) of 2 in a 1 cm cell. (4 marks)
13. Calculate the pH of a solution of hypochlorous acid (HClO) of concentration  $1.26 \times 10^{-2} \text{ M}$  ( $K_a = 3.2 \times 10^{-6} \text{ moldm}^{-3}$ ) (4 marks)
14. Outline the procedures involved in gravimetric analysis. (4 marks)
15. State, with reasons, an element that is analysed by flame photometry. (4 marks)

### SECTION B (40 marks)

*Answer any TWO questions from this section.*

16. (a) State **three** types of chromatography. (3 marks)
- (b) Describe the separation of the components of a sample using paper chromatography. (17 marks)
17. (a) Define the following terms:
- (i) Calorie (2 marks)
- (ii) Joule (2 marks)
- (b) Draw a labelled diagram of a bomb calorimeter. (10 marks)
- (c) Calculate the calorific value in Kcal/g of a 2 g maize sample which raised the temperature of 15 kg of water by  $10^\circ\text{C}$  in a bomb calorimeter (The specific Heat capacity of water is  $4200\text{J/kg}^\circ\text{C}$ ). (6 marks)
18. (a) Sketch curves on the same axis to show how molar conductivity varies with dilution of:
- (i) a strong electrolyte; (2 marks)
- (ii) a weak electrolyte. (2 marks)

- (b) Give an explanation of the curves obtained in a(i) and a(ii) above. (4 marks)
- (c) Calculate:
- (i) the conductivity; (6 marks)
- (ii) molar conductivity of a 0.2 M solution measured in 2.5 cm long electrolytic cell of cross sectional area,  $1.50 \text{ cm}^2$  giving a resistance of  $14.2 \Omega$ . (6 marks)
19. (a) List the components of a colorimeter. (5 marks)
- (b) State, with reasons, the conditions for a satisfactory colorimetric analysis. (8 marks)
- (c) Outline the sequence of analysis using a colorimeter. (7 marks)