1408/313
CHEMISTRY TECHNIQUES
June/July 2010
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

CHEMISTRY TECHNIQUES

3 hours

INSTRUCTIONS TO CANDIDATES

*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 3 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. State any **four** sample storage methods. (4 marks)

2. (a) Define pH. (1 mark)

   (b) Calculate pH of 0.1M NaOH solution. (3 marks)

3. $25cm^3$ of a solution prepared using Na_2CO_3 was neutralized by $24.8cm^3$ of 0.2MHCl. Determine the molarity of the Na_2CO_3. (4 marks)

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

5. State any **four** factors that affect efficiency in column chromatography. (4 marks)

6. (a) Define ppm. (1 mark)

   (b) Calculate the mass of sodium nitrate (Fw = 85) that must be dissolved in $250cm^3$ of solution so as to make a 100ppm with respect to sodium. (Na = 23, N =14, O = 16) (3 marks)

7. Explain why alkali metals are analysed by flame photometry. (4 marks)

8. A current of 5A was passed through a solution of copper (II) sulphate for two minutes. Calculate the volume of oxygen liberated at the anode. (IF = 96500C, gas molar volume = 24 litres at r.t.p). (4 marks)

9. $20cm^3$ of 0.05M $AgNO_3$ was mixed with excess of NaCl solution. Calculate the mass of AgCl precipitated. (Ag = 108, Cl = 35.5, Na = 23, O = 16, N = 14). (4 marks)

10. List any **four** methods of determining the purity of a substance. (4 marks)

11. State any **four** techniques used in purification of substances after separation. (4 marks)

12. (a) State Beer-Lambert's Law. (1 mark)

    (b) State **three** causes of deviation from Beer-Lambert's Law. (3 marks)

13. (a) State **three** advantages of soxhlet extraction as a method of separating mixtures. (3 marks)

    (b) State **one** disadvantage of soxhlet extraction. (1 mark)

14. (a) Convert the following absorbance values into transmittance percent:
    (a) 0;
    (b) 2. (4 marks)

15. Differentiate between grab and composite samples as used in Chemistry techniques. (4 marks)

SECTION B (40 marks)

*Answer any **Two** questions from this section.*

16. (a) A sample of $KMnO_4$ absorbs visible radiation at 545nm. Describe how the wavelength of 545nm is practically determined. (7 marks)

(b) An 80ppm solution of $KMnO_4$ produced an abosorbance of 0.4 in a 1.0 cm cuvette. Calculate the molar absorptivity of $KMnO_4$ (K = 39, Mn = 55, O = 16). (9marks)

(c) State **four** advantages of colorimetry over other classical methods of analysis such as titrimetry and gravimetry. (4 marks)

17. (a) The amount of protein in a sample of cheese is determined by a Kjeldahl analysis for proteins. After digesting a 0.9814 g sample of cheese, the nitrogen is oxidised to NH_4^+ and converted to NH_3 with NaOH. The NH_3 is then distilled into a flask containing 50cm³ of 0.1047M HCl. The excess HCl is then backtitrated with 22.84cm³ of 0.1183M NaOH.
Calculate the percentage of protein in the cheese sample given that there is 6.38g of protein for every gram of nitrogen in most dairy products. (N = 14, H = 1) (13 marks)

(b) Draw the KJeldahl apparatus. (7 marks)

18. (a) 25cm³ of a sample solution containing 3.816gdm⁻³ of the crystals of $Na_2B_4O_7.nH_2O$ required 25cm³ of 0.02M HCl to reach the methyl orange end-point. Given that the ionic equation of the reaction taking place is:

$$B_4O_{7(aq)}^{2-} + 2H_{(aq)}^{+} + 5H_2O_{(l)} \longrightarrow 4H_3BO_3$$

determine the value of n in $Na_2B_4O_7.nH_2O$.

(Na = 23, B = 10.8, O = 16, H = 1) (10 marks)

(b) State **six** conditions necessary for analysis of a sample by volumetric analysis. (6 marks)

(c) State **four** advantages of titrimetry as a method of analysis. (4 marks)

19. (a) Define electrolysis. (1 mark)

(b) State **three** factors that affect the products of electrolysis. (3 marks)

(c) State **three** applications of electrolysis. (3 marks)

(d) A current of 5A was passed through a solution containing the salt MCl_n for 15.2 minutes. 1.512124g of metal M and 567cm³ of chlorine gas were produced at r.t.p
Determine the formula of the salt.
(M = 64, Cl = 35.5, IF = 96500C, gas molar volume = 24dm³). (13 marks)