Scan

1408/313
CHEMISTRY TECHNIQUES
June/July 2017
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

CHEMISTRY TECHNIQUES

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Scientific calculator (battery operated).
*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.*
Maximum marks for each part of a question are indicated.
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.

Turn over

SECTION A (60 marks)

Answer ALL the questions in this section.

1. List any **four** qualities of an ideal washing liquid in gravimetric analysis. (4 marks)

2. State **four** conditions which necessitate back titration in volumetric analysis. (4 marks)

3. State **four** requirements of a primary standard substance. (4 marks)

4. Name any **four** methods of identification of spots in paper chromatography. (4 marks)

5. List any **four** methods which are used to determine the end point in redox titrations. (4 marks)

6. Give **four** advantages of gravimetric methods over titrimetric methods. (4 marks)

7. Differentiate between gravity and vacuum filtration. (4 marks)

8. 0.18 g of a dibasic acid completely reacted with 20 cm^3 of 0.1 M sodium hydroxide. Calculate the relative molecular mass of the acid. (4 marks)

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

   (b) The limiting ionic molar conductivity of sodium ions is 50.1 Ω^{-1} cm^2mol^{-1} and that of chloride ions is 76.3 Ω^{-1} cm^2mol^{-1}. Calculate the limiting molar conductivity of sodium chloride. (2 marks)

10. Define the following terms as used in electrolysis:

    (a) electrolyte;
    (b) anode;
    (c) cathode;
    (d) cations.

    (4 marks)

11. Calculate the pH of a solution of NaOH whose concentration is 0.1 M. (4 marks)

12. Distinguish between matrix matching and wet ashing as used in flame photometry. (4 marks)

13. Name **two** types of flames and **two** types of burners used in flame photometry. (4 marks)

14. List **four** advantages of thin layer chromatography over paper chromatography. (4 marks)

15. A certain solute has a distribution coefficient of 5 between water and chloroform. A 50 cm^3 sample of a 0.05 M aqueous solution of the solute was extracted with 15 cm^3 of chloroform. Determine the extraction efficiency of the separation. (4 marks)

SECTION B (40 marks)

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

16. (a) State the meaning of the following terms as used in titrimetric analysis:

(i) titrant; (1 mark)

(ii) titrand; (1 mark)

(iii) equivalent point; (1 mark)

(iv) end point. (1 mark)

(b) Name **four** classes of titrimetric methods. (4 marks)

(c) 2.5 g sample of limestone was dissolved in 50 cm^3 of 1 M HCl. The resulting solution was made to 250 cm^3 with distilled water. 25 cm^3 of this solution required 21.05 cm^3 of 0.1 M NaOH for complete neutralization. Assuming all the basic material to be calcium carbonate, calculate the percentage of calcium carbonate in the limestone.

(Ca = 40, C = 12, O = 16, Na = 23, H = 1). (12 marks)

17. (a) List **four** properties of an ideal precipitate. (4 marks)

(b) Give any **three** reasons why precipitates are ignited. (3 marks)

(c) Distinguish between digestion and peptisation as used in gravimetry. (2 marks)

(d) An iron ore was analysed by dissolving 1.1324 g sample in concentrated hydrochloric acid. The resulting solution was diluted with water and the iron was precipitated as hydrated iron (III) oxide. After filtration and washing the residue was ignited to give 0.5394 g of pure Fe_2O_3. Calculate the percentage of iron in the ore.

(Fe = 56, O = 6) (6 marks)

(e) A substance has a molar absorptivity of 2.17×10^3 l $mol^{-1}cm^{-1}$. Determine the molar concentration of a solution of the substance whose transmittance is 8.42% in a 2.4 cm cell. (5 marks)

18. (a) Explain the meaning of the electroplating as used in electrolysis. (1 mark)

(b) List **two** applications of electroplating. (2 marks)

(c) Draw a labelled diagram showing how an iron spoon can be electroplated with copper, and write both the cathodic and anodic equations. (6 marks)

(d) List **three** properties of an ideal deposit in electrogravimetry. (3 marks)

(e) An element has a relative atomic mass of 88. When a current of 0.5 A was passed through the molten chloride of the element for 32 minutes 10 seconds, 0.44 g of the element was deposited at the cathode. Calculate the number of faradays needed to liberate 1 mole of the element (1 F = 96500 C). (8 marks)

19. (a) Define the following terms:

(i) buffer solution;
(ii) buffering capacity. (4 marks)

(b) Calculate the pH of the solution produced by adding 10 cm^3 of 1 M HCl to 1 litre of a solution which is 0.1 M ethanoic acid and 0.1 M sodium acetate. ($K_a = 1.75 \times 10^{-5}$ mol l^{-1}). (8 marks)

(c) Name **six** fractions involved in proximate analysis. (6 marks)

(d) Define the following terms as used in proximate analysis:

(i) ash; (1 mark)

(ii) crude fibre. (1 mark)

THIS IS THE LAST PRINTED PAGE.