THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN SCIENCE LABORATORY TECHNOLOGY

MODULE I

CHEMISTRY TECHNIQUES I

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 TWO 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 indicated.
Candidates should answer the questions in English.

This paper consists of 5 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 questions in this section.

1. State **four** differences between a physical and a chemical change. (4 marks)

2. Name **four** criteria for determining purity of a substance. (4 marks)

3. List **four** properties of ionic compounds. (4 marks)

4. (a) Define the term 'relative atomic mass'. (2 marks)

    (b) Determine the percentage of carbon in calcium carbonate.
    $(Ca = 40, C = 12, O = 16)$ (2 marks)

5. An organic compound contains 37.5% carbon, 12.5% Hydrogen and the rest is oxygen. Determine the empirical formula of the compound.
    $(C = 12, H = 1, O = 16)$ (4 marks)

6. Explain why the ionic radius of a non-metallic element is greater than its atomic radius. (4 marks)

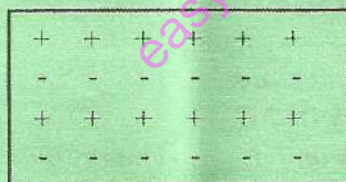7. Figure 1 shows a chemical structure.

Fig. 1

    (a) Name:

    (i) the type of bonding in the structure; (1 mark)

    (ii) the period to which the structure belongs; (1 mark)

    (iii) the group to which the structure belongs. (1 mark)

    (b) Identify the element represented by the structure. (1 mark)

8. Define each of the following terms:

    (a)   hydrocarbon;   (2 marks)

    (b)   isomerism.   (2 marks)

9. Write the IUPAC names of each of the following compounds:

    (a) CH_4 (1 mark)

    (b) C_2H_4 (1 mark)

    (c) C_2H_3Cl (1 mark)

    (d) C_2H_5OH (1 mark)

10. State **four** factors which affect chemical equilibrium.   (4 marks)

11. Name **four** storage methods of chemical samples in the laboratory.   (4 marks)

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

13. Determine the mass of anhydrous sodium carbonate required to prepare a 100 cm³ of 0.1 M solution.
(Na = 23, C = 12, O = 16)   (4 marks)

14. Calculate the pH of a 0.1 M sodium hydroxide solution.   (4 marks)

15.   (a)   List **two** properties of acids.   (2 marks)

    (b)   Distinguish between a strong acid and a weak acid.   (2 marks)

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

16. Table I shows a section of the periodic table containing four elements U, V, W and X. The letters are not the actual symbols of the elements.

Table I

I			III	IV	V	VI	VII	O
	II					V		W
							X	
U								

(a) Identify the letter which represents:

    (i)   a halogen;   (1 mark)

    (ii)   a noble gas;   (1 mark)

    (iii)   an alkali metal.   (1 mark)

(b) State with a reason the element with the smallest atomic radius.   (3 marks)

(c) Write the formula for the compound formed between:

    (i)   V and X;   (1 mark)

    (ii)   V and U.   (1 mark)

(d) An element Z, combines with 0.72 g of magnesium to form 1 g of a white solid. Determine the formula of the white solid. (Mg = 24, Z = 14)   (6 marks)

(e) Balance the following chemical equations:

    (i) $Al(OH)_3 + HNO_3 \longrightarrow Al(NO_3)_3 + H_2O$ (2 marks)
             (s)   (aq)   (aq)   (ℓ)

    (ii) $Al_2O_3 + HNO_3 \longrightarrow Al(NO_3)_3 + H_2O$ (2 marks)
             (s)   (aq)   (aq)   (ℓ)

    (iii) $Ca(HCO_3)_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$ (2 marks)
             (s)   (aq)   (s)   (ℓ)

17. A mass of 0.5 g of impure copper (II) oxide reacted with 50 cm^3 of 0.1 M nitric acid. (Cu = 64, O = 16, N = 14, H = 1)

    (a)   Name the type of reaction that took place. Give a reason.   (2 marks)

    (b)   Write a balanced chemical equation for the reaction.   (2 marks)

    (c)   Calculate the number of moles of nitric acid that reacted.   (4 marks)

    (d)   Calculate the number of moles of copper (II) oxide in the impure sample.   (2 marks)

    (e)   Determine the mass of copper (II) oxide in the sample.   (3 marks)

    (f)   Determine the percentage of copper (II) oxide in the sample.   (2 marks)

    (g)   Calculate the mass of copper present in the sample.   (5 marks)

18.   (a)   State the Le - Chateliers principle.   (2 marks)

    (b)   Ammonia is manufactured according to the following equation:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad \Delta H = -92 KJMol^{-1}$$
$$(g) \quad (g) \qquad (g)$$

        Explain what happens to the yield of ammonia when:

       (i)   more hydrogen gas is introduced into the system;   (3 marks)

       (ii)   pressure of the system is reduced;   (3 marks)

       (iii)   temperature is increased;   (3 marks)

       (iv)   a catalyst is used.   (3 marks)

    (c)   Draw the structure of each of the following organic compounds:

       (i)   butan-1-ol;   (2 marks)

       (ii)   pentanol;   (2 marks)

       (iii)   chloroethane.   (2 marks)

19.   (a)   Determine the amount of pure sodium chloride required to prepare 250 ml, 100 ppm solution of sodium ions. (Na = 23, Cl = 35.5)   (8 marks)

    (b)   Describe the laboratory preparation of the solution in (a).   (8 marks)

    (c)   Distinguish between a working solution and a stock solution.   (4 marks)

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