

1904/104

CHEMISTRY TECHNIQUES I

June/July 2022

Time: 3 hours



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 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 carried 20 marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 8 printed pages ✓

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

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Turn over

SECTION A (60 marks)

Answer ALL the questions in this section.

1. Define each of the following terms:

- (a) solution; (1 mark)
- (b) solute; (1 mark)
- (c) solvent; (1 mark)
- (d) saturated solution. (1 mark)

2. Taking the symbol ${}^16_8\text{X}$ to represent an atom of element X. Determine the:

- (a) atomic number; (1 mark)
- (b) mass number; (1 mark)
- (c) number of electrons; (1 mark)
- (d) number of neutrons. (1 mark)

3. The electronic configuration for elements represented by letters W, X, Y and Z are $2.8.6$, $2.8.2$, $2.8.1$ and $2.8.8$ respectively.

- (a) Identify the element which forms a:
 - (i) double charged anion; (1 mark)
 - (ii) soluble carbonate. (1 mark)
- (b) Determine the element with the smallest atomic radius and give a reason. (2 marks)

4. (a) List **two** physical properties of alkali metals. (2 marks)

(b) Table I shows the melting points of three alkali metals.

Table I

Alkali metal	Melting point (°C)
Lithium	180
Sodium	98
Potassium	63

Explain the trend in the melting points of the three elements. (2 marks)

5. Give the IUPAC names of the following organic compounds:

(a) C_2H_2 (1 mark)

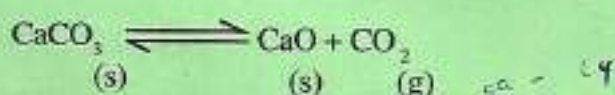
(b) C_3H_6 (1 mark)

(c) C_2H_4 (1 mark)

(d) C_2H_5OH (1 mark)

6. (a) State the law of mass action as applied in a state of chemical equilibrium. (1 mark)

(b) The decomposition of calcium carbonate is represented by the following equation.



Explain how an increase in pressure would affect the equilibrium position. (2 marks)

(c) Other than pressure, state **one** factor which affects the position of equilibrium in a reversible reaction. (1 mark)

7. Name **four** techniques of a solid sample pre-treatment in a chemistry laboratory. (4 marks)

8. List **four** requirements of a primary standard substance. (4 marks)

9. Calculate the molarity of a solution containing 4.9 g of sulphuric acid in 500 cm³ solution (H = 1, S = 32, O = 16). (4 marks)

10. List two properties of:

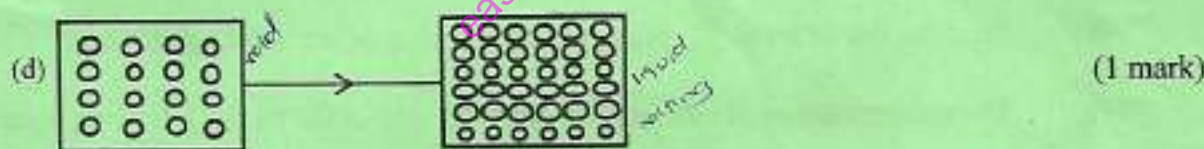
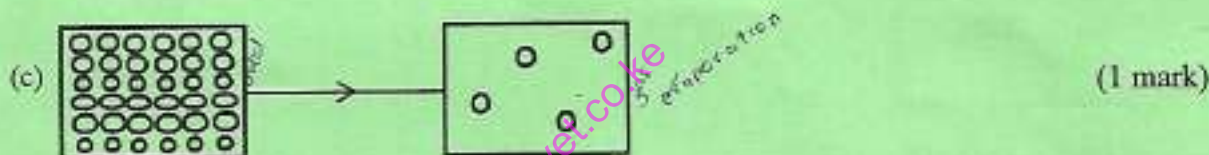
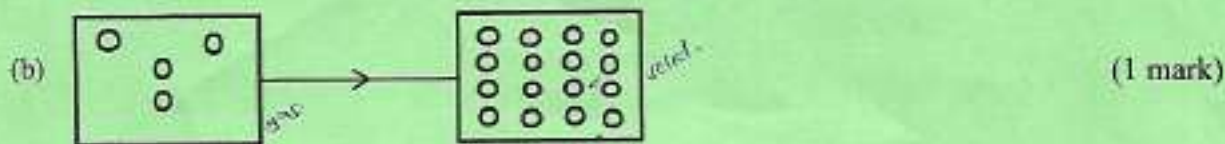
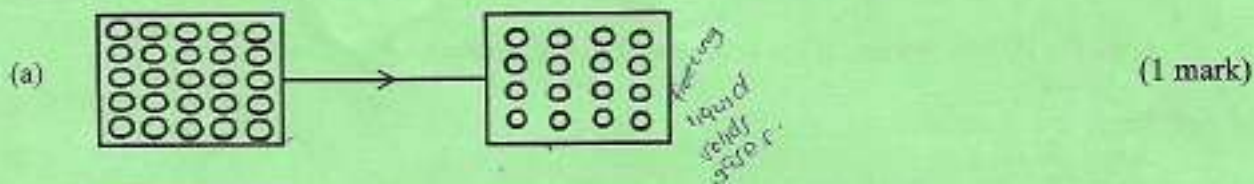
(a) acids; (2 marks)

(b) bases. (2 marks)

11. (a) Define the term 'pH'. (1 marks)

(b) Explain the meaning of the term 'universal indicator'. (3 marks)

12. Name the physical processes represented by the following changes:



NB: The symbol \circ represents a particle

13. (a) The following illustration shows part of the periodic table. The letters are not the actual symbols of the elements.

1							
2	3		4	N	6	P	8
Q	M		11	12	13	14	R
16	17		18	19	20		

Identify the element that:

- (i) forms giant covalent structures; (1 mark)
- (ii) does not form compounds. (1 mark)
- (b) (i) Write the formula of the compound formed when element M reacts with chlorine. (1 mark)
- (ii) Name the type of bond in the compound formed in b(i) (1 mark)
14. 0.4 g of sodium hydroxide pellets were dissolved in 1 litre of distilled water. Determine the concentration of the solution in:
- (a) moles per litre; (2 marks)
- (b) parts per million (ppm). (2 marks)
15. (a) Write a balanced reaction equation between ethane and 1 mole of chlorine gas. (2 marks)
- (b) Draw the structure of the halo-alkane produced in (a) and give its IUPAC name. (2 marks)

SECTION B (40 marks)

Answer any TWO questions from this section.

16. A 2.4 g piece of magnesium ribbon was cleaned in steel wool and then completely burnt in the presence of oxygen. The produce weighed 4 g after cooling.
- (a) Explain why:
- (i) it was necessary to clean the ribbon; (1 mark)
- (ii) there was an increase in mass. (1 mark)
- (b) Write a:
- (i) balanced equation for this reaction; (2 marks)
- (ii) word equation for the reaction. (1 mark)

- (c) Calculate the number of moles of oxygen used during the burning of the ribbon (O= 16). (4 marks)
- (d) The product in (b) was dissolved in water and then filtered. The resulting solution was tested with both blue and red litmus papers. Explain the observation. (3 marks)
- (e) State **four** properties of:
- (i) ionic compounds; (4 marks)
- (ii) covalent compounds. (4 marks)

17. Table II give information about particles A, B, C, D, E and F.

Table II

Particle	Protons	Neutrons	Electrons
A	3	4	2
B	9	10	10
C ✓	12	12	12 ✓
D ✓	17	18	17
E	17	20	17
F	18	22	18

- (a) Identify the letter(s) that represent(s):
- (i) a neutral atom of a metal; (1 mark)
- (ii) noble gas; (1 mark)
- (iii) pair of isotopes; (1 mark)
- (iv) cation; (1 mark)
- (v) anion. (1 mark)
- (b) (i) Write a balanced equation for the reaction between atoms of C and D. (2 marks)
- (ii) Name the type of chemical bond formed in b(i). (1 mark)
- (iii) Determine the mass number of particle B. (1 mark)
- (iv) Name the period and the group of the periodic table to which particle D belongs. (2 marks)
- (v) Write the spdf electronic configuration of particle E. (1 mark)

(c) The following is a list of salts:

- Sodium carbonate ✓
- Silver chloride
- Barium sulphate
- Ammonium nitrate

Identify **two** salts that are:

(i) soluble in water; (2 marks)

(ii) insoluble in water. (2 marks)

(d) State the meaning of each of the following:

(i) endothermic reaction; (1 mark)

(ii) exothermic reaction. (1 mark)

(e) State the effect of an increase in temperature on a reversible:

(i) endothermic reaction; (1 mark)

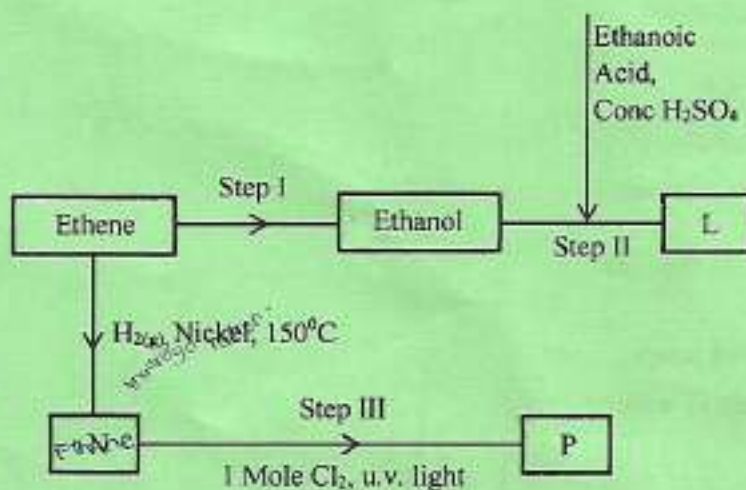
(ii) exothermic reaction. (1 mark)

18. (a) State the IUPAC names of the following compounds:



(b) Describe a chemical test that can be used to distinguish between compounds in a(i) and (ii). (4 marks)

- (c) The flow chart shows a series of reactions starting with ethene.



- (i) Name compounds L, N and P. (3 marks)
- (ii) Draw the structure of compound N. (2 marks)
- (iii) List the reagents used in step I. (2 marks)
- (iv) State the type of reactions that take place in steps I, II and III. (3 marks)
- (d) The relative formula mass of an alkane is 58.
- (i) Write the general formula of the alkane. (1 mark)
- (ii) Determine the molecular formula of the alkane. (3 marks)
19. (a) Determine the molarity of a solution prepared by dissolving 3.15 g of nitric acid in 250 ml of water (H = 1, N = 14, O = 16). (5 marks)
- (b) 20 cm³ of the solution in (a) was titrated against 25 cm³ of a solution of sodium hydroxide. Determine the concentration of the hydroxide in moles per litre. (6 marks)
- (c) Calculate the amount of NaOH required to prepare 0.1 M solution in a 250 ml volumetric flask (NaOH = 40). (4 marks)
- (d) Describe how the solution in (c) is prepared in the laboratory. (5 marks)

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