

2916/102
MATHEMATICS AND
PHYSICAL SCIENCE
June/July 2023
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN NUTRITION AND DIETETICS
MODULE I

MATHEMATICS AND PHYSICAL SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

answer booklet;

geometrical set;

mathematical tables/non-programmable calculator.

This paper consists of TWO sections; A and B.

Answer any THREE questions from section A and any TWO questions from section B in the answer booklet provided.

ALL questions carry equal marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 7 printed pages.

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

© 2023 The Kenya National Examinations Council.

Turn over

SECTION A: PHYSICAL SCIENCE (60 marks)

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

1. (a) The atomic symbol of an element is ${}_{19}^{39}\text{X}$.
- (i) Write the electronic arrangement of element X. (1 mark)
- (ii) Determine the:
- (I) period in the periodic table to which element X belong. (1 mark)
- (II) chemical family to which element X belong. (1 mark)
- (III) group in the periodic table to which element X belong. (1 mark)
- (b) (i) Using dots (•) and crosses (X), describe the bonding between an atom of element X and a chlorine atom. (2 marks)
- (ii) Name the type of bond in (i) above. (1 mark)
- (iii) List **three** general characteristics of the bond named in (ii) above. (3 marks)
- (c) The table below shows atomic numbers of elements U, V, W and Z. The letters are not the actual symbols of the elements.

Element	Atomic Number
U	17
V	10
W	11
Z	12

- (i) Identify by writing the letter of the element which represents:
- (I) a halogen; (1 mark)
- (II) a noble gas; (1 mark)
- (III) an alkali metal; (1 mark)
- (IV) an alkaline earth metal. (1 mark)
- (ii) Explain why element W is more reactive than element Z. (2 marks)
- (iii) Write a balanced equation for the reaction between element W and water. (2 marks)

- (iv) State the observations made when the products of the reaction in (iii) is tested with blue and red litmus papers. (2 marks)
2. (a) (i) Define the term 'hydrocarbon'. (1 mark)
- (ii) A hydrocarbon with a RMM of 28 contains 85.7% by mass of carbon. Determine the:
- (I) molecular formula of the hydrocarbon (C = 12, H = 1). (7 marks)
- (II) homologous series to which the hydrocarbon belongs. (1 mark)
- (iii) Name the type of reaction between the hydrocarbon and hydrogen chloride. (1 mark)
- (b) (i) Define each of the following:
- (I) molarity; (1 mark)
- (II) standard solution. (1 mark)
- (ii) Calculate the amount of sodium carbonate required to prepare 1 litre of a 1 molar solution.
(Na = 23, C = 12, O = 16) (4 marks)
- (iii) Determine the volume of the solution in (ii) required to prepare a 100 ml of a 0.005 M solution of sodium carbonate. (4 marks)
3. (a) (i) State the Charles' law. (1 mark)
- (ii) The pressure of nitrogen gas contained in a 1 litre cylinder at -196°C is 1.0×10^7 Pascals. Determine the volume of the gas at 25°C and 1.0×10^5 Pascals. (5 marks)
- (iii) The ideal gas equation is expressed as $pV = nRT$. State the meaning of the symbols of the equation. (5 marks)
- (b) (i) State Hess's law. (1 mark)
- (ii) List **four** factors which affect the rate of a chemical reaction. (4 marks)
- (c) The molar heat of combustion of carbon is $393.5 \text{ kJ mol}^{-1}$. Determine the amount of heat energy required to completely burn 0.25 moles of carbon. (4 marks)

4. (a) A micrometer screw gauge has a -0.05 mm error. State the reading on the instrument when used to measure the diameter of a wire whose actual diameter is 0.35 mm . (2 marks)
- (b) Figure 1 shows a straw used to suck milk from a glass. Explain why it is difficult to suck the milk using the straw. (3 marks)

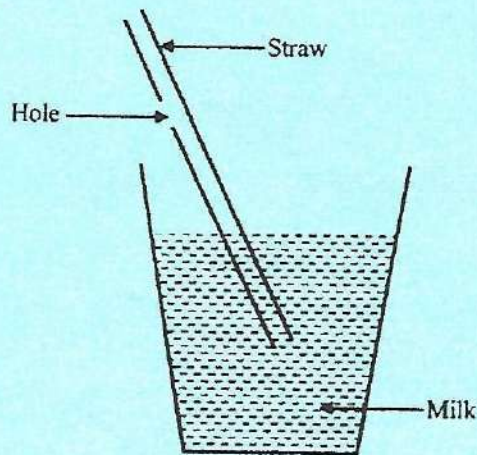


Fig. 1

- (c) (i) Define 'surface tension'. (1 mark)
- (ii) State **two** ways of reducing surface tension of a liquid. (2 marks)
- (d) (i) Define density, stating its SI units. (2 marks)
- (ii) The volume of a liquid contained in a syringe is 10 cm^3 . The mass of the liquid and the syringe is 30 g , while the mass of the empty syringe is 20 g . Determine the density of the liquid in SI units. (4 marks)
- (e) (i) State **three** factors which determine the pressure in a liquid. (3 marks)
- (ii) A beaker of height 0.2 m is filled with a liquid of density $13,600 \text{ kg/m}^3$. Determine the pressure due to the liquid at the bottom of the beaker. ($g = 10 \text{ N/kg}$). (3 marks)

5. (a) (i) State the principles of moments. (1 mark)
- (ii) Figure 2 shows a uniform plank of length 2 m and weight 50 N. It is pivoted at a distance, X from one end and balanced by a weight of 75 N hanged as shown. Determine the value of X in metres. (4 marks)

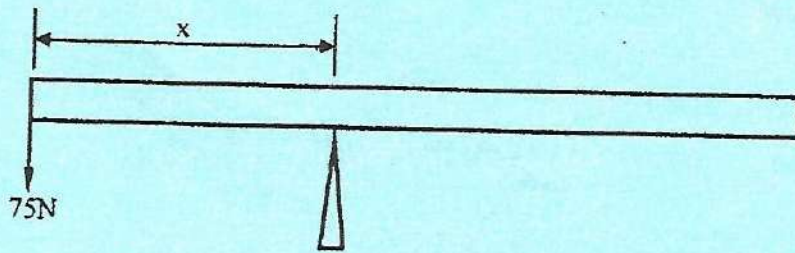


Fig. 2

- (b) (i) Name the **three** modes of heat transfer. (3 marks)
- (ii) State **two** reasons why water is not suitable for use as a thermometric liquid. (2 marks)
- (c) The speed of a body moving in a straight line increased from 4.2 m/s to 10.4 m/s in 20 seconds. Determine the:
- (i) average speed; (2 marks)
- (ii) acceleration; (3 marks)
- (iii) distance covered. (2 marks)
- (d) (i) State the law of conservation of linear momentum. (1 mark)
- (ii) Determine the momentum of a body of mass 50 kg moving at a velocity of 20 m/s. (2 marks)

SECTION B: MATHEMATICS (40 marks)

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

6. (a) Evaluate $\frac{2}{3}$ of $\left(3.25 - 1.75 \div \frac{7}{8}\right)$ without using a calculator. (5 marks)
- (b) Determine the value of $Ca^2 - (b - a)$, given that $a = -3$, $b = -1$ and $c = 4$. (5 marks)
- (c) Solve for x in the equation $\frac{10x + 6}{14} = \frac{4x + 10}{6}$. (4 marks)

- (d) The sides of a rectangle are as shown in figure 3. Given that the area of the rectangle is 160 cm^2 , determine the values of x and y . (6 marks)

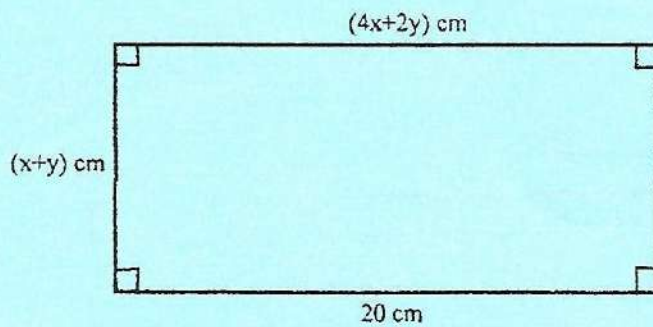


Fig. 3

7. A wholesaler sells buns to a retailer at Ksh 10 each.

- (i) Calculate the amount paid to the wholesaler for supplying 6000 buns. (1 mark)
- (ii) If the retailer sells each bun for Ksh. 15, determine the percentage profit realized from the sale of all the buns supplied. (4 marks)
- (c) The following data represents the masses in grams of 15 cakes prepared during a practical lesson.

8, 15, 18, 13, 15, 28, 30, 17, 41, 27, 17, 17, 44, 31 and 24.

Determine the:

- (i) mode; (1 mark)
- (ii) median; (2 marks)
- (iii) mean mass. (3 marks)
- (d) A straight line passes through the points A (1, -3) and B(2,8). Determine the:
- (i) gradient of the line; (2 marks)
- (ii) equation of the line in the form $\frac{x}{a} + \frac{y}{b} = 1$ (5 marks)
- (iii) value of a and b. (2 marks)

8. (a) A tourist on a holiday in Kenya converted 12,000 Swiss francs to Kenya shillings at an exchange rate of 1 Swiss franc for Ksh 102.20. If the tourist spends Ksh 502,000 and re-converted the remainder to Swiss francs at the same rate, determine the amount of money received. (7 marks)
- (b) A nutritionist used two types of cereals **A** and **B** to prepare a health porridge flour mixture. The health porridge flour was prepared by mixing 30 bags of type **A** cereal with 50 bags of type **B** cereal. A bag of type **A** cereal was bought at Ksh 4,000 and that of type **B** was at Ksh 3,500.
- (i) Determine the cost of one bag of the health porridge flour. (8 marks)
- (ii) If the nutritionist wanted to sell the flour at 30% profit, determine the selling price of one bag of healthy porridge. (2 marks)
- (c) Given the matrices $X = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ and $Z = \begin{bmatrix} 3p & 5q \\ 4r & 3s \end{bmatrix}$, determine p, q, r and s if $2X = Z$. (3 marks)

easytvet.com

THIS IS THE LAST PRINTED PAGE.