

2916/102
MATHEMATICS AND
PHYSICAL SCIENCE
Oct/Nov. 2022
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 table / non-programmable scientific calculator.

This paper consists of TWO sections; A and B.

Answer any THREE questions in 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 6 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: PHYSICAL SCIENCE (60 marks)

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

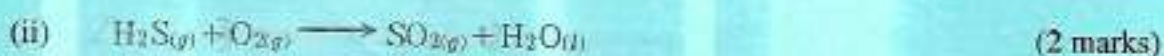
- I. (a) An element Q has 18 Neutrons and a mass number of 34.
- (i) Draw the atomic structure of Q. (2 marks)
 - (ii) Name the group and the period of the periodic table to which Q belongs. (2 marks)
 - (iii) Write the formula of the ion of Q. (1 mark)
- (b) Table I gives information about the atomic numbers of elements A to E.

Table I

Element	Atomic number
A	11
B	13
C	14
D	17
E	19

- (i) Write the electron configuration of the ions of B and D. (2 marks)
- (ii) Select the letter representing the most reactive non-metal. (1 mark)
- (iii) Explain why element E loses its outermost electron more easily than A. (2 marks)
- (iv) Draw a cross (x) and dot (·) electron diagrams to show bonding in the compound formed between elements C and D. (4 marks)
- (v) Write an equation for the reaction that would occur between A and water. (2 marks)

(c) Balance the following chemical equations.



2. (a) Give the IUPAC names of the following organic compounds.
- (i) C_3H_8OH (1 mark)
 - (ii) CH_3COOH (1 mark)
 - (iii) C_2H_2 (1 mark)
 - (iv) C_2H_4 (1 mark)
 - (v) C_2H_6 (1 mark)
- (b) Determine the empirical formula of a hydrocarbon, given that the percentage of carbon in the compound is 79.9% (C = 12, H = 1). (5 marks)
- (c) (i) State Boyle's law; (2 marks)
- (ii) List any **four** assumptions of the kinetic theory of gases. (4 marks)
- (d) Define the following terms:
- (i) dynamic equilibrium; (2 marks)
 - (ii) rate of chemical reaction. (2 marks)
3. (a) Name **four** colligative properties of solutions. (4 marks)
- (b) State the effect of solute concentration on the freezing point and boiling point of a solution. (2 marks)
- (c) (i) State Hess's law; (2 marks)
- (ii) Distinguish between heat of combustion and heat of formation. (4 marks)
- (d) (i) List **four** factors which affect chemical equilibrium. (4 marks)
- (ii) List the ions present during the electrolysis of copper (II) sulphate solution. (4 marks)
4. (a) State **three** basic qualities of measurement and their standard units. (6 marks)
- (b) Define the following terms:
- (i) elasticity; (1 mark)
 - (ii) stress; (1 mark)
 - (iii) strain; (1 mark)

- (i) Young's modulus. (1 mark)
- (c) (j) State the principle of moments. (2 marks)
- (ii) The beam shown in figure 1 is supported at its centre.

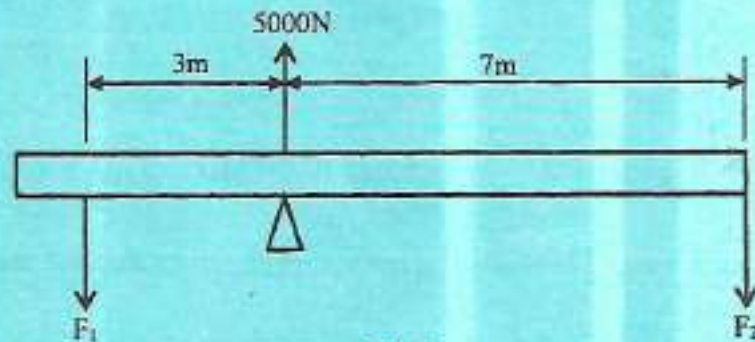


Fig. 1

Determine the values of F_1 and F_2 when the beam is in equilibrium.

(8 marks)

5. (a) (i) Define the term pressure and state its SI units. (3 marks)
- (ii) State the principle of transmission of pressure in a liquid. (1 mark)
- (iii) A tank contains water to a depth of 0.6 m. Calculate the pressure exerted by the water at the base of the tank. (Density of water = 1000 kg / m^3 , $g = 10 \text{ m/s}^2$) (3 marks)
- (b) (i) State the principle of conservation of linear momentum. (2 marks)
- (ii) The momentum of a body is 160 kg m/s when the velocity is 2.5 m/s . Determine the mass of the body. (3 marks)
- (c) Distinguish between heat capacity and specific heat capacity. State the SI units in each case. (4 marks)
- (d) State Ohms law. (2 marks)
- (e) List any two types of X-rays. (2 marks)

SECTION B: MATHEMATICS (40 marks)

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

6. (a) Without using a calculator, evaluate:

$$\frac{2\left(9\frac{1}{2} - 3\frac{1}{3} \div \frac{5}{9}\right)}{\frac{3}{5} \text{ of } 6\frac{1}{4}}$$

(5 marks)

- (b) A college student spends Ksh. 970 on buying three textbooks and five pens. He saves Ksh. 90 if he buys two textbooks and eight pens. Determine the cost of a textbook and a pen.

(5 marks)

- (c) **Table 2** shows height measurements in centimetres of trainees in a nutrition and dietetics class.

Table 2

100 104 108 116 103 116

127 120 125 125 128 127

110 112 121 101 152 126

128 151 102 150 142 150

133 112 140 128 152 140

- (i) Construct a frequency table starting with class interval of 100 - 109, 110 - 119 ...

(8 marks)

- (ii) Determine the mean height of the class.

(2 marks)

7. (a) Determine the equation of a straight line which passes through points P (3, 2) and Q (6, 8).

(4 marks)

- (b) The volume of a gas is directly proportional to its temperature. A certain gas occupies a volume of 5.0 cm³ at 400 K.

- (i) Form an equation relating volume and temperature.

(2 marks)

- (ii) Determine temperature when the volume is 6.0 cm³.

(2 marks)

(c) Simplify the expression:

$$\frac{y-1}{y} - \frac{2y+1}{3y}$$

hence solve the equation:

$$\frac{y-1}{y} - \frac{2y+1}{3y} = \frac{2}{3}$$

(4 marks)

(d) On the same axes, draw the graphs of:

(i) $2x + y = 6$

(ii) $2y = 3x - 2$

Hence solve the simultaneous equations:

$$2x + y = 6$$

$$3x - 2y = 2$$

(8 marks)

8. (a) A solid hemisphere of radius 5.8 cm has a density of 10.5 g/cm^3 . Calculate its:

(i) volume;

(3 marks)

(ii) mass.

(2 marks)

(b) A nutritionist bag contains 7 oranges, 5 mangoes and 9 apples. Two fruits are picked one at a time with replacement.

(i) Represent the information in form of a tree diagram.

(3 marks)

(ii) Determine the probability of picking:

(I) two apples;

(2 marks)

(II) one mango and one apple in that order.

(2 marks)

(c) A businessman has 20,000 South African Rand, 150,000 Japanese Yen, 5,000 US Dollars and 3,000 Sterling Pounds. He converted all currencies into Kenyan Shillings and purchased goods worth Ksh. 600,000. The goods attracted custom duty of 30%.

Calculate the amount of money remaining in US Dollars.

(8 marks)

1 South African Rand = ksh 7.80

1 Japanese Yen = ksh 0.7535

1 US Dollar = ksh 101

1 Sterling Pounds = ksh 150

10 ksh = 100
100 ksh = 1000

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