

2913/102
MATHEMATICS AND
APPLIED SCIENCE
June/July 2020
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN FOOD SCIENCE AND PROCESSING TECHNOLOGY

MODULE I

MATHEMATICS AND APPLIED SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Geometrical set;

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 15 marks while each question in section B carries 20 marks.

Maximum marks for each part of a question are as shown.

Candidates should answer the questions in English.

This paper consists of 9 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 (60 marks)

Answer ALL the questions in this section.

1. (a) Without using a calculator, evaluate $\frac{36 - 8 \times -4 - 15 \div -3}{-3 \times -3 + 8(-6 + -2)}$. (3 marks)
- (b) Given that $a:n = 3:4$ and $n:c = 6:5$, determine $a:c$. (3 marks)
- (c) Determine matrix Y given that $A+B=Y$. Matrix $A = \begin{pmatrix} 2 & 0 \\ -2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & -1 \\ 3 & 2 \end{pmatrix}$ (3 marks)
- (d) Solve for x in $3 \log x - \log 2 = \log 32$. (3 marks)
- (e) Salim bought 4 cocks and 3 goats at Ksh 18,300.00 while John bought 3 cocks and 1 goat for Ksh 8,100.00. Determine the price of a cock if the prices of a cock and a goat remained the same in the two transactions. (3 marks)
2. (a) Table I shows the physical properties of matter. Complete the table. (3 marks)

Table I

Basic physical Quantity	SI unit	Symbol of unit	Measuring Instruments
Time	Second	s	---
---	Ampere	A	Ammeter
Luminous intensity	---	Cd	Photometer

- (b) Explain how each of the following factors affect surface tension of water:
- (i) impurities; (1 mark)
- (ii) temperature. (1 mark)
- (c) (i) A body of mass 4 kg is moving at 12 ms^{-1} before colliding with a stationary body of mass 6 kg. If the bodies stick together, calculate their common velocity. (3 marks)
- (d) (i) State Ohm's law. (1 mark)
- (ii) Calculate the voltage across a conductor of resistance 0.4Ω with 4 A flowing through it. (3 marks)

- (e) Complete the diagram in Figure 1 to show the pattern of light waves across the single narrow slits. (3 marks)

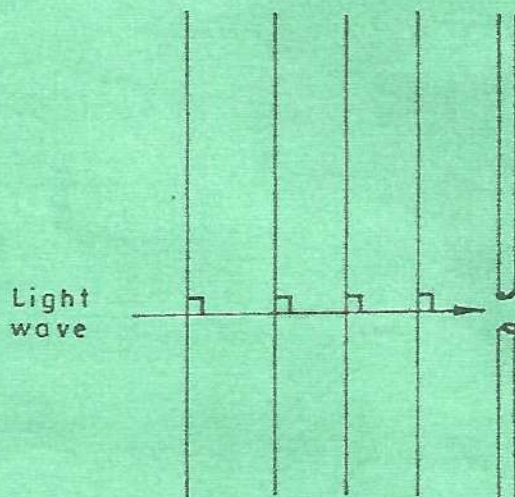


Fig. 1

3. (a) Element A has an atomic mass of 23 and 12 neutrons.
- Write the electron arrangement of A using s, p, d, f notation. (2 marks)
 - Write the chemical equation for the reaction between A and chlorine gas. (2 marks)
- (b) An organic compound, J, contains 64.99% carbon, 13.55% hydrogen and the rest is oxygen. The relative molecular mass of J is 74. Given that C = 12, H = 1 and O = 16, determine the molecular formulae of J. (4 marks)
- (c) Two hydrocarbon compounds are represented by the formulae C_3H_8 and C_3H_6 .
- Name the hydrocarbon series to which each of them belong. (2 marks)
 - Identify the compound which is unsaturated. (2 marks)
- (d) A sample of a gas occupies a volume of 120 cm^3 at 40°C under a pressure of 110 kPa. Determine its temperature if it occupies 105 cm^3 under a pressure of 125 kPa. (3 marks)

4. (a) Figure 2 shows a sperm cell.

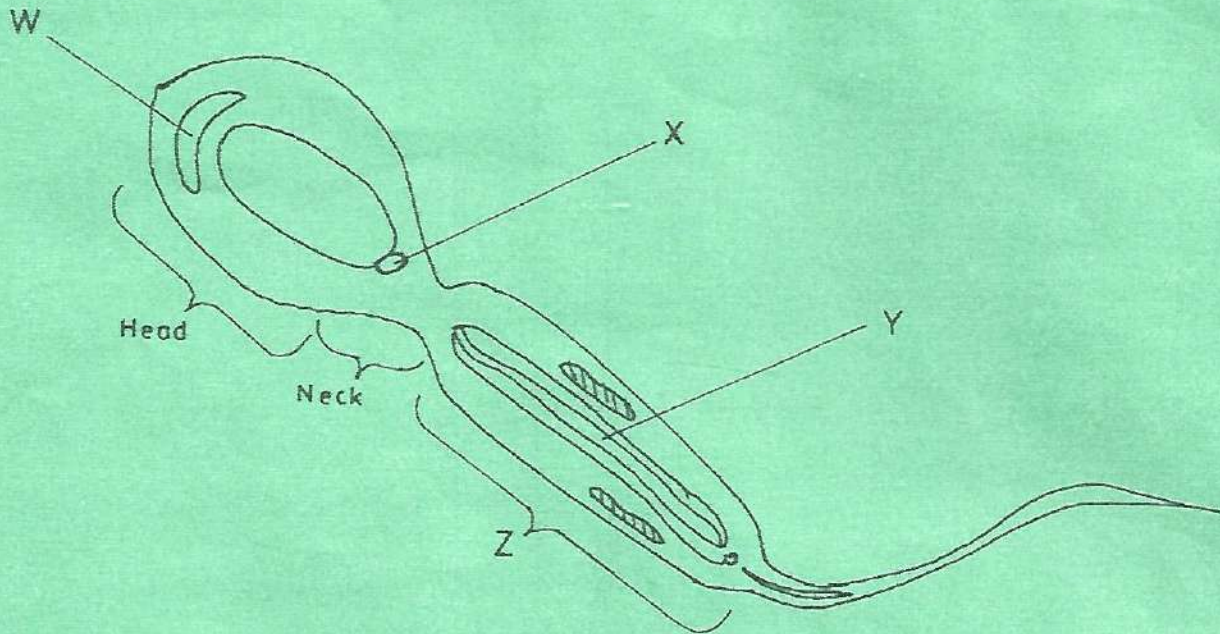


Fig. 2

- (i) Identify the parts labelled X and Y. (2 marks)
- (ii) Explain how parts labelled W and Z adapt the cell to its function. (4 marks)
- (b) Figure 3 represents a cell organelle as seen under the electron microscope.

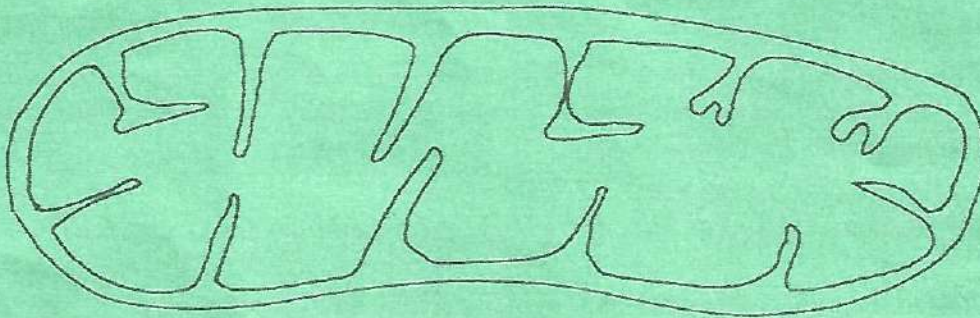


Fig. 3

- (i) Identify the organelle. (1 mark)
- (ii) State the function of the organelle named in (b)(i) above in the cell. (1 mark)
- (iii) State **one** visible adaptation that makes it suitable to perform its function. (1 mark)
- (iv) Name **one** cell that has a large number of the organelle named in (b)(i). (1 mark)

(c) Figure 4 represents the organ of an animal.

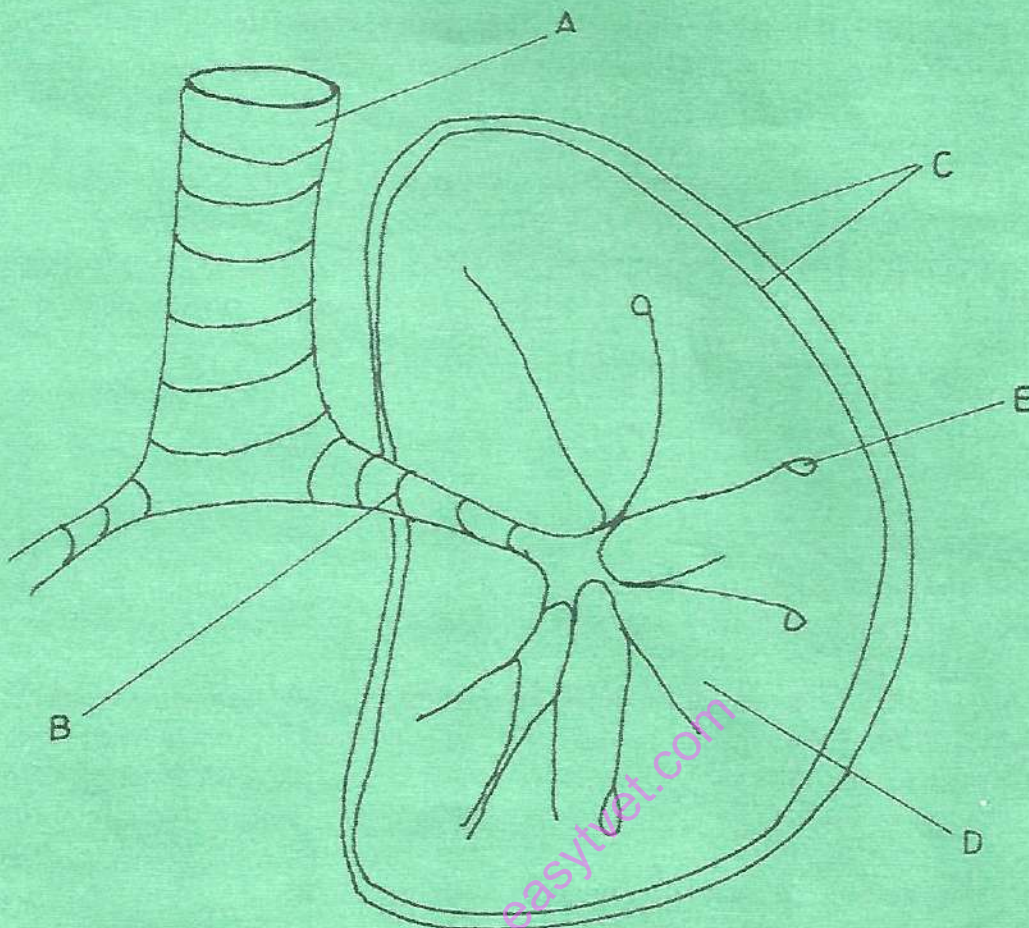


Fig. 4

- (i) Identify the parts labelled A and B. (2 marks)
- (ii) State the function of the part labelled C. (1 mark)
- (iii) Explain two adaptations of part labelled E to its function. (2 marks)

SECTION B (40 marks)

Answer any *TWO* questions from this section.

5. (a) A Swiss tourist arrived in Kenya with 10,000,000.00 Swiss francs. She exchanged the Swiss francs to Kenyan shillings at the rate of 1 Swiss franc to Ksh 54.70. While in the country she used Ksh 250,000.00 and changed the rest back to Swiss francs at the same rate. Calculate the amount in Swiss francs she received back to the nearest whole franc. (4 marks)

- (b) Expand and simplify $(x - 2)^2 - (x + 2)^2$. (4 marks)
- (c) A lady deposited Ksh 250,000.00 in a savings account at the rate of 6% p.a simple interest. Calculate the time it would take to earn an interest of Ksh 36,000.00. (3 marks)
- (d) Table 2 shows frequency distribution for a test given to 120 first year students with the maximum mark of 20.

Table 2

Mark	1 - 5	6 - 10	11 - 15	16 - 20
Frequency	2	61	x	19

Determine:

- (i) the value of x ; (1 mark)
- (ii) the modal class; (1 mark)
- (iii) the mean mark. (3 marks)
- (e) A tank whose dimensions are 2 m long, 1.5 m wide and 2 m deep contains water to a depth of 25 cm. Determine the amount of water in litres which should be added to make the tank half-full. (4 marks)
6. (a) A student performed a practical to separate cream from milk.
- (i) Name a device used to carry out this task. (1 mark)
- (ii) Explain how the device works. (2 marks)
- (b) A piece of copper of mass 60 g and specific heat capacity 390 J/kg K cools from 90°C to 40°C. Calculate the quantity of heat lost. (3 marks)
- (c) A cell drives a current of 2.0 A through a 0.6 Ω resistor. When the same cell is connected to a 0.9 Ω resistor, the current that flows is 1.5 A. Determine the internal resistance and the e.m.f. of the cell. (4 marks)
- (d) Sketch in Figure 5 the magnetic field pattern indicating the neutral point. (3 marks)



Fig. 5

8. (a) Distinguish between homodont and heterodont dentition as used in animal nutrition: (2 marks)
- (b) Explain how chloroplast is adapted to its function. (4 marks)
- (c) Figure 6 shows a nerve cell.

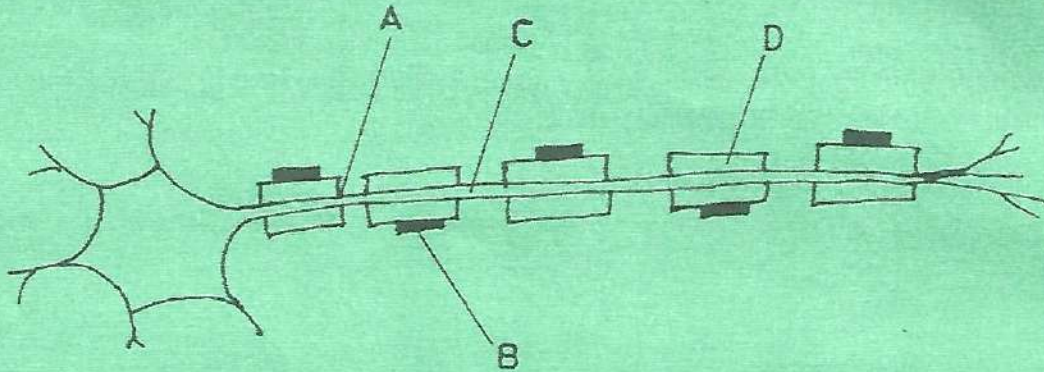


Fig. 6

- (i) Identify the type of neurone; *multipolar neuron* (1 mark)
- (ii) Name the parts labelled B, C and D. (3 marks)
- (iii) State the function of part labelled A. (1 mark)
- (d) Figure 7 shows a feeding relationship in an ecosystem.

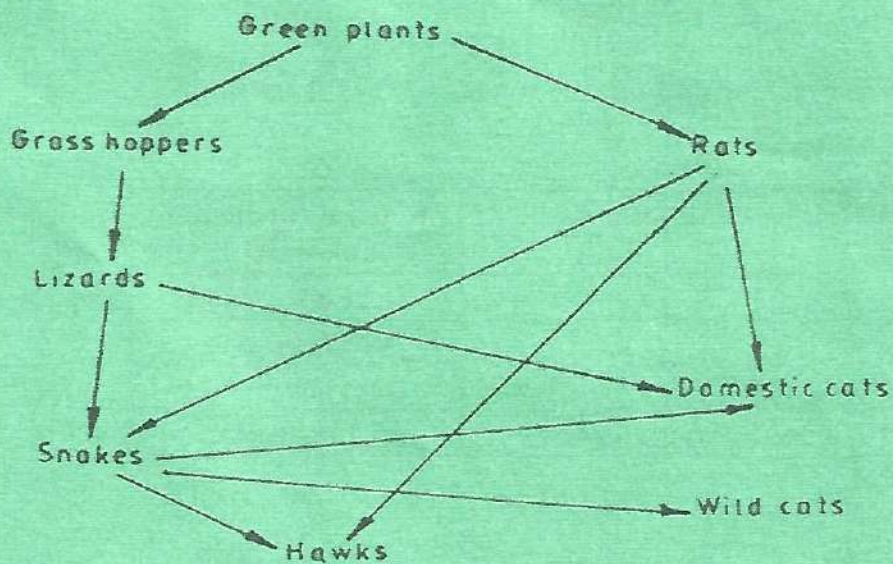


Fig. 7

- (i) Construct two food chains ending with a tertiary consumer in each case. (2 marks)

- (ii) Identify the animal with the highest variety of predators in the food web. (1 mark)
- (iii) State **three** effects of prolonged drought on the ecosystem. (3 marks)
- (e) A student carrying out research caught an organism and observed that it had the following characteristics features:
- Body divided into two parts.
 - Had eight legs.
- (i) Identify the class to which the organism belongs. (1 mark)
- (ii) State **two** other characteristic features the members belonging to the class are likely to have. (2 marks)

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