2914/102
2915/102
MATHEMATICS AND APPLIED SCIENCE
June/July 2019
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN APPLIED BIOLOGY

DIPLOMA IN ANALYTICAL CHEMISTRY

MODULE I

MATHEMATICS AND APPLIED SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Scientific calculator (battery operated).
*The paper consists of **TWO** sections; **A** and **B**.*
*Answer **ALL** the questions in **BOTH** Section A and 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 the question are indicated.
Candidates should answer all 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.

SECTION A: (60 marks)

*Answer **ALL** the questions in this section.*

1. (a) State **two** advantages of using a parabolic reflection in car headlamps. (2 marks)

   (b) A concave mirror has a focal length 20 cm Determine the position, size and nature of the image when the object is placed 30 cm infront of the mirror. (2 marks)

2. (a) Differentiate between potential difference and electromotive force. (2 marks)

   (b) A wire 0.60 m long and a diameter 4×10^{-4} m has a resistance of 2 Ω. Determine resistivity of the material. (2 marks)

3. State any **four** properties of an electromagnetic spectrum. (4 marks)

4. Differentiate between hard X-rays and soft X-rays. (4 marks)

5. (a) Differentiate between scalar and vector quantities. (2 marks)

   (b) Explain why an oil drop spreads on water surface. (2 marks)

6. Given the points A(3,6), B(5,9) and C(9,15).

   Find:

   (a) AB and BC. (2 marks)

   (b) The relationship between AB and BC. (2 marks)

7. Integrate with respect to t:

   $\frac{1}{2}t^3 + \frac{1}{3}t^2$

   (4 marks)

8. (a) Simplify:

   $$\frac{2p - 2q - xp + xq}{p - q}$$

   (2 marks)

   (b) A square has sides x cm. One side of the square is increased by 4 cm while the other side is reduced by 6 cm. The area of the rectangle formed is 24 cm². Find the length of the side of the square.

   (2 marks)

9. (a) State Hooke's law. (2 marks)

(b) A spring stretches by 2.0 cm when a weight of 5.0 N is hang from it. Determine the force that produces an extension of 2.5 cm. (2 marks)

10. (a) Define Cathode Ray Tube (CRT). (1 mark)

(b) (i) Name the operational parts of a Cathode Ray Oscilloscope (CRO). (1 mark)

(ii) State any **two** uses of CRO. (2 marks)

11. (a) Differentiate between molecular forces and nuclear forces. (2 marks)

(b) An object has a mass of 250 kg. Find:

(i) its weight on the surface of the moon given that the gravitational pull on the moon is 1.7 N Kg^{-1}. (1 mark)

(ii) If the same object weighs 1000 N on a certain planet, calculate the acceleration due to gravity on this planet. (1 mark)

12. Explain how Bernoulli's principle affects the aerofoil. (4 marks)

13. Find the constant term in the expansion of:

$$\left(2x - \frac{1}{3x^2}\right)^9$$

(4 marks)

14. Solve the following simultaneous equations by matrix method:

$$2x - y = 4$$
$$3x + 2y = -1$$

(4 marks)

15. A TV set was bought on hire purchase. A down payment of Ksh 5,000 was paid and a 15 monthly instalments of Ksh 1500 was required.

(a) Calculate the total amount paid on hire purchase. (2 marks)

(b) If hire purchase payment is 20% higher than cash payment, find the cash price. (2 marks)

SECTION B: (40 marks)

*Answer **ALL** the questions in this section.*

16. (a) A group of students set up an experiment to investigate a physiological process. The set up was as shown in figure 1.

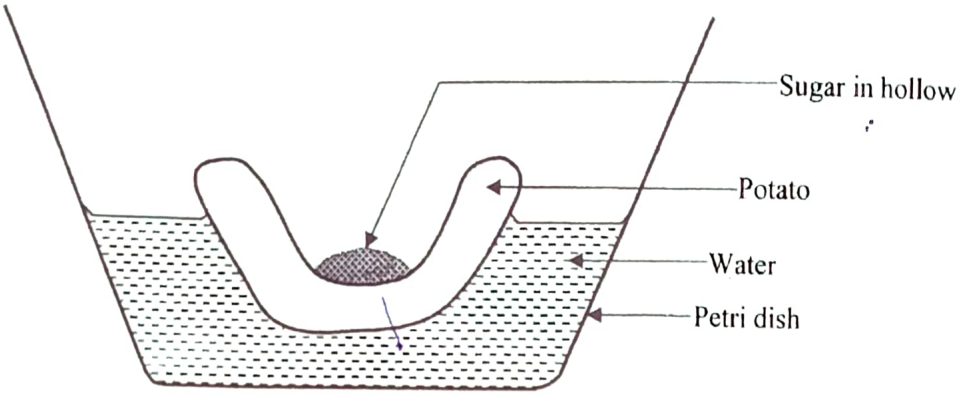

Fig. 1

After sometimes the student observed that the level of the sugar solution had risen.

(i) Identify the physiological process investigated. (1 mark)

(ii) Account for the rise in the level of sugar solution in the experiment. (4 marks)

(iii) With reasons, suggest the observations if the experiment was repeated using a piece of boiled potato. (4 marks)

(b) (i) State the structural differences between arteries and veins in mammals. (3 marks)

(ii) Describe the process of ultrafiltration in the mammalian kidney. (8 marks)

17. (a) A solution of sodium carbonate of concentration 0.100 mol dm^{-3} is used to standardise a solution of hydrochloric acid. 25.0 cm^3 of the standard solution of the sodium carbonate requires 35.0 cm^3 of acid for neutralisation. Calculate the concentration of the acid. (10 marks)

(b) (i) Define the term electrolysis. (2 marks)

(ii) Distinguish between a strong and a weak electrolyte. (2 marks)

(iii) Figure 2 shows an incomplete diagram of a set-up intended to measure the standard electromotive force of a cell.

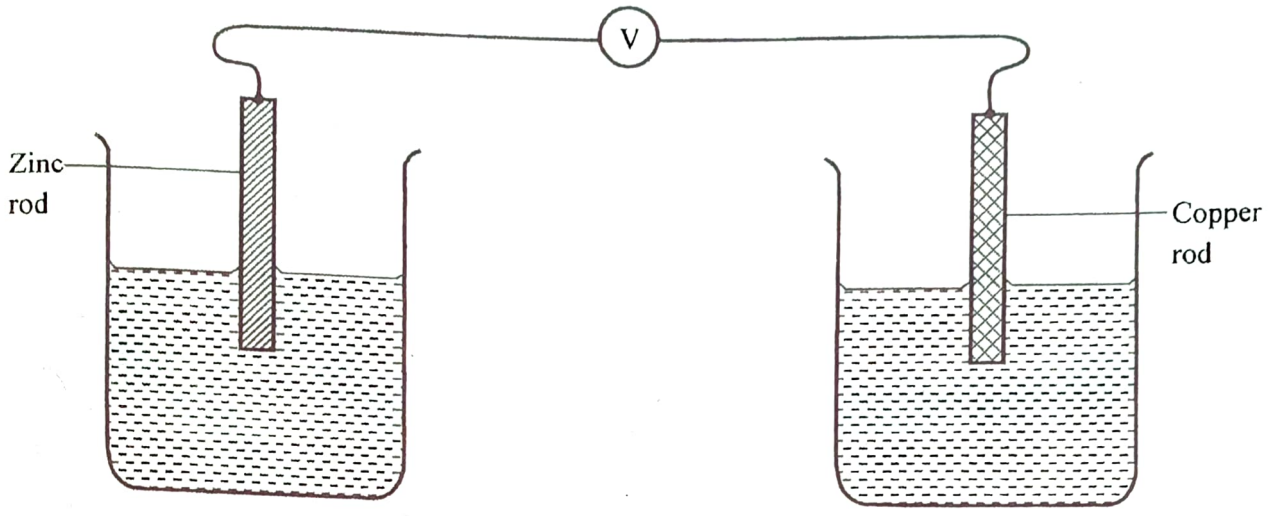

Fig. 2

Using a piece of copper, a piece of zinc, 1.0 M copper sulphate, 1.0 M zinc sulphate and saturated solution of potassium chloride. Complete the diagram. (6 marks)

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