1704/102
MATHEMATICS I AND PHYSICAL SCIENCE
June/July 2019
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN BUILDING TECHNOLOGY

MODULE I

MATHEMATICS I AND PHYSICAL SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
- *Answer booklet;*
- *Mathematical tables/non programmable scientific calculator;*
- *Drawing instruments.*

*This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.*
*Answer **FIVE** questions choosing **TWO** questions from each section and **ONE** other question from either section.*
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 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.

Turn over

SECTION A: MATHEMATICS I

*Answer at least **TWO** questions from this section.*

1. (a) The number of livestock in different homesteads in a certain county were as follows:

5, 6, 4, 2, 1, 3, 8, 9, 5, 3, 8, 4, 6, 0, 5, 2, 6, 7, 5, 7
12, 11, 17, 4, 8, 5, 10, 4, 3, 4, 2

Find the:

(i) mode;

(ii) median;

(iii) mean. (8 marks)

(b) Make U the subject of the formula:

$x = \frac{UV}{U + 2w}$. (4 marks)

(c) What is the simple interest earned on Sh 2,000 at 12% per annum for 3 years. (6 marks)

(d) The length L cm of a wire varies directly as the temperature T° C. The length of the wire is 5 cm when the temperature is 65° C. Calculate the length of the wire when the temperature is 69° C. (2 marks)

2. (a) Without using calculators, find the sum of 0.0017, 10.237, 7 and 0.03. (2 marks)

(b) Plot the graph $y = \sin 2x$ *for* $0° \leq x \leq 360°$. (6 marks)

(c) Convert the following degrees to radians giving your answers in terms of π.

(i) 60°; (2 marks)

(ii) 405°; (2 marks)

(iii) 280°; (2 marks)

(d) A farmer has 100 m of wire mesh to fence a rectangular enclosure. What is the greatest area he can enclose with the wire mesh. (6 marks)

3. (a) Given the arithmetic sequence 4, 11, 18, ... Write down the first term and 6th term of the sequence. (2 marks)

(b) The sum of the first three terms of a geometric series is 26. If the common ratio is 3, find the sum of the first six terms. (6 marks)

(c) Solve the following trigonometric equation:

$5\sin^2\theta = 3\sin\theta + 2$ *for* $0 \leq \theta \leq 360°$. (7 marks)

(d) Solve the simultaneous equations:

$y = x^2 - 3x + 1$ and $y = 6 - 2x$ graphically. (5 marks)

4. (a) Solve in the following equations:

(i) $6^{2x+1} = 2^{2x+1}$; (4 marks)

(ii) $8^{y+1} + 2^{3y+1} = 160$. (4 marks)

(b) Given that log 8 = 0.9031, log 12 = 1.0792, without using mathematical tables or calculator, evaluate log 0.096. (5 marks)

(c) Solve the quadratic equation by completing the square method $2x^2 + 4x + 1 = 0$. (4 marks)

(d) Use reciprocal tables to evaluate $\frac{1}{x} = \frac{1}{0.2759} + \frac{1}{46.76}$. (3 marks)

SECTION B: PHYSICAL SCIENCE

*Answer at least **TWO** questions from this section.*

5. (a) Define the following terms:

(i) allotrophy;

(ii) direct synthesis;

(iii) electrolysis;

(iv) basicity. (4 marks)

(b) Explain why sodium chloride is a poor conductor of electricity in the solid state but a good conductor in molten and solution form. (4 marks)

(c) Explain why:

(i) molecular substances have low melting and boiling points;

(ii) iodine tends to break easily into flakes (sublimes);

(iii) hydrogen gas is molecular and does not dissolve in water. (6 marks)

(d) Write the equations for the decomposition of:

(i) sodium hydrogen carbonate;

(ii) copper (II) sulphate;

(iii) silver nitrate. (6 marks)

6. (a) What are the SI units for the following quantities:

(i) length;

(ii) area;

(iii) mass;

(iv) volume;

(v) time. (5 marks)

(b) Distinguish between:

(i) distance and displacement;

(ii) speed and velocity. (4 marks)

(c) (i) A force 200 N pulls a body of mass 50 kg and overcomes a constant frictional force of 40 N. What is the acceleration of the body. (5 marks)

(ii) State **two** laws of friction. (4 marks)

(iii) State Newton's law of universal gravitation. (2 marks)

7. (a) The air pressure at the base of a mountain is 75.0 cm of mercury while at the top it is 60.0 cm of mercury. Given that the average density of air is $1.25\ kgm^{-3}$ and the density of mercury is $13,600\ kgm^{-3}$, calculate the height of the mountain. (7 marks)

(b) Give **two** properties of the liquid used as brake fluid. (3 marks)

(c) State Hooke's law. (2 marks)

(d) A metal cube suspended freely from the end of a spring causes it to stretch by 5.0 cm. A 500 g mass suspended from the same spring stretches it by 2.0 cm. If the elastic limit is not exceeded:

(i) find the weight of the metal cube;
(ii) calculate the length the spring will stretch if a mass of 1.5 kg is attached to its end. (8 marks)

8. (a) Calculate the work done by a stone mason in lifting a stone of mass 15 kg through a height of 2.0 m.

Take $10\,m/s^2$. (4 marks)

(b) State the law of conservation of energy. (3 marks)

(c) Define the following terms associated with machines:

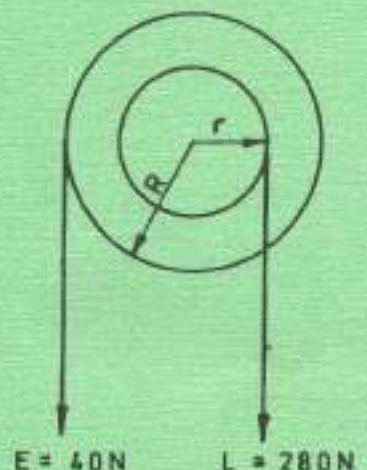
(i) effort (E);
(ii) load (L);
(iii) mechanical advantage (M.A).

(3 marks)

(d) A wheel and axle is used to raise a load of 280 N by a force of 40 N applied to the rim of the wheel. If the radii of the wheel and axle are 70 cm and 5 cm respectively, calculate:

(i) mechanical advantage;
(ii) velocity ratio;
(iii) efficiency.

(10 marks)



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