2705/102 2709/102
2707/102 2710/102
MATHEMATICS I AND
PHYSICAL SCIENCE
June/July 2018
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING TECHNOLOGY
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE

MODULE I

MATHEMATICS I AND PHYSICAL SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Mathematical tables/ Scientific calculator;
Drawing instruments.
*This paper consists of **EIGHT** questions in **TWO** sections: **A** and **B**.*
*Answer **FIVE** questions choosing **TWO** questions from section **A**, **TWO** questions from section **B** and **ONE** 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 4 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) Solve

$$3^{2x+5} = 8^{x-6}$$ (5 marks)

(b) Solve

$$\log(9x^2 - 1) + 2\log x = \log(3x - 1) + \log x$$ (7 marks)

(c) Make r the subject of the formula.

$$A = P\left(1 + \frac{r}{100}\right)^n$$ (4 marks)

(d) Given P(5,6, −1), Q(−2,4,2) and R(1,2,3). Write $\underset{\sim}{PQ}$ and $\underset{\sim}{PR}$ in terms of unit vectors. (4 marks)

2. (a) The following are the ages of 50 students in an engineering class.

20	25	30	29	31	21	26	51	41	20
22	31	32	28	27	26	20	22	22	31
23	25	27	26	26	22	21	23	27	29
25	29	20	27	24	23	39	33	34	24
25	28	24	28	20	24	20	31	25	26

(i) Make a frequency distribution table starting with 20-24, 25-29 ...
(ii) Draw an Ogive curve, then use it to estimate the median. (13 marks)

(b) A bag contains 8 red balls and 6 blue balls. Two balls are drawn at random without replacement. Use a tree diagram to find the probability that:

(i) the two balls are of the same colour.
(ii) the first ball is red and the second ball is blue. (7 marks)

3. (a) Given that 2n+1, 4n and 5n +1 are the first three terms in an arithmetic progression, find

(i) the value of n;
(ii) the fifth term;
(iii) the sum of the first 8 terms. (8 marks)

(b) Express $\frac{3x+6}{2x^2 - x - 1}$ as partial fractions. (7 marks)

(c) Divide $6x^3 + 7x^2 - 7x - 3$ by $3x + 2$. (5 marks)

4. (a) Solve the following simultaneous equations:

$$x + 3y - z = -5$$
$$3x - y + 2z = 5$$
$$x + y + 2z = 3$$

(9 marks)

(b) Solve $4Sinx + 3Cosx = 4$ for $0 \leq x \leq 360°$. (9 marks)

(c) How many ways can 5 people sit in a bench? (2 marks)

SECTION B: PHYSICAL SCIENCE

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

5. (a) Differentiate between core and valence electrons. (4 marks)

(b) Name **three** types of primary bonds. (3 marks)

(c) Outline the properties of covalent bonds. (6 marks)

(d) With the aid of a sketch, describe the hydrogen bonds. (7 marks)

6. (a) List **three** kinds of radioactive decay. (3 marks)

(b) Differentiate between nuclear fusion and nuclear fission. (4 marks)

(c) The activity of mercury $^{184}Hg_{80}$ is 750 Bq. Determine its activity after 80 seconds. (half-life 30.9 sec) (7 marks)

(d) Outline **three** applications of radioactivity. (6 marks)

7. (a) Define the following terms:

(i) acid salt;
(ii) amphoteric substance;
(iii) an alkali. (6 marks)

(b) Using formulae, state **three** methods of salt preparation. (6 marks)

(c) Describe **two** ways of softening hard water. (8 marks)

8. (a) State **five** properties of images formed by plane mirrors. (5 marks)

(b) A concave mirror produces a real image 1 cm tall of an object 2.5 mm tall placed 5 cm from the mirror. Find the position of the image and the focal length of the mirror. (10 marks)

(c) A vehicle travelling at an initial velocity of 20 km/h, accelerates at 4 m/s^2. Calculate its final velocity after 10 seconds. (5 marks)

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