1704/102
MATHEMATICS I AND
PHYSICAL SCIENCE
Oct. / Nov. 2016
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;*
- *Scientific calculator/ mathematical tables;*
- *Drawing instruments.*

*This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.*
*Answer any **FIVE** questions choosing at least **TWO** questions from each 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 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.

Turn over

SECTION A: MATHEMATICS I

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

1. (a) In a construction site having three technicians, technician A works for nine consecutive days before taking one day off. Technician B works for twelve consecutive days before taking one day off. Technician C works for twenty one days before taking one day off. After how long will the site have no technician? (6 marks)

(b) Solve the following leaving your answer in fraction in its simplest form.

$$\frac{0.75}{3} + 0.278$$ (2 marks)

(c) Convert 0.78 into a fraction. (4 marks)

(d) Solve the equation: $\text{Log}_2(x-2) + \text{Log}_2(2x+3) = 2$. (8 marks)

2. (a) Transpose $x - P = \sqrt{x^2 + L^2}$ to make x the subject. (3 marks)

(b) Solve the simultaneous equations:

$$3x + 4y = 13$$
$$2x - 3y = 20$$ (3 marks)

(c) The figure 1 below shows a metal template. If the total area is 425.6 cm^2, find the value of r. (4 marks)

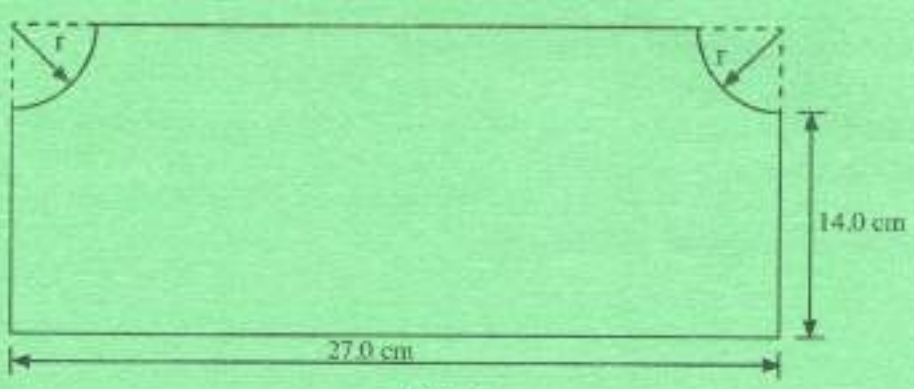

Figure 1

(d) The third, fourth and fifth terms of a geometric progression (G.P.) are: $t + 3$, $t + 8$ and $t + 18$ respectively.

(i) Find the value of t; (2 marks)

(ii) Find the sum of the first 10 terms. (6 marks)

(e) Calculate the geometric mean of 4 and 64. (2 marks)

3. (a) The figure 2 below shows the dimensions of a bucket. Determine correct to four significant figures, the volume of the bucket. (4 marks)

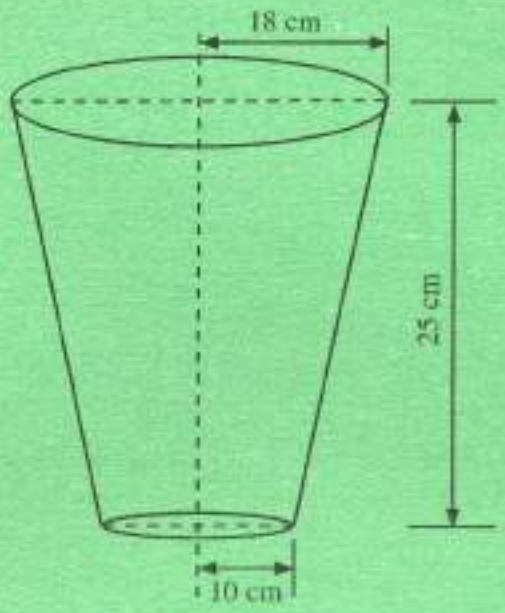

Figure 2

(b) If the outside of the bucket in figure 2 above has to be painted, calculate the surface area to be painted. (4 marks)

(c) A rope 35 m long is fixed at a point and rotated through an angle of 120°. Find the distance made by the rope on the edge of figure 3. (4 marks)

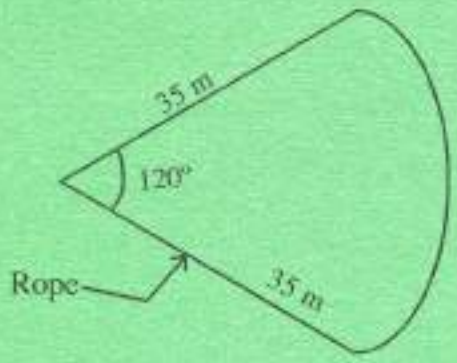

Figure 3

(d) The number of personnel in a Consulting Engineering firm is given in the table 1 below:

Table 1

Directors	Associate Directors	Civil Engineers	Technician Engineers	Technicians	Administrative Staff
2	5	7	6	12	4

Represent this information in a pie chart. (4 marks)

(e) The moisture content in percentage (%) of fifteen (15) samples of timber were determined in a laboratory and are shown below:

15, 11.5, 14, 11, 12, 13.5, 10, 12.5, 13, 13.5, 11.4, 13.6, 10.5, 12.8 and 9.8

Calculate the mean, mode and median. (4 marks)

4. (a) If Sin A = $\frac{2}{5}$ and A is acute,

(i) Find Cos A and $\tan^2 A$. (2 marks)

(ii) $\text{Sec}^2 A$. (4 marks)

(b) Given Sine A = $\frac{4}{5}$ and Cos B = $\frac{5}{13}$ and that all the angles are acute, find Sin (A + B) = Sin B Cos A. (4 marks)

(c) The crushing strengths (units in N/mm^2) of fifty concrete cubes are given below. Group the data into seven classes between thirty two (32) to fifty two (52):

45	34	46	40	37	40	35	40	34	43	40
35	39	38	46	45	44	34	50	35	39	38
47	48	37	42	50	39	46	41	41	51	42
34	49	36	47	48	49	50	48	44	43	51
41	37									

(i) Find the frequency of each group. (4 marks)

(ii) Calculate the mean and modal class. (6 marks)

SECTION B: PHYSICAL SCIENCE

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

5. (a) Define the following terms:

(i) atoms;
(ii) elements;
(iii) compounds.

(4 marks)

(b) Describe the structure of an atom. (6 marks)

(c) (i) Describe **two** methods of salt preparation. (4 marks)

(ii) Outline an experiment to distinguish between the acids and bases in a laboratory. (2 marks)

(d) State **four** properties of a base. (4 marks)

6. (a) (i) Describe **two** methods of separating a mixture of two solids. (3 marks)

(ii) Differentiate between chemical and physical change. (2 marks)

(b) State any **four** basic physical quantities and their S.I units. (4 marks)

(c) A half metre rule is pivoted at 30 cm mark. If a mass of 10 g is placed at 50 cm mark and it balances horizontally, sketch a diagram showing all the forces acting on the half metre rule and find its mass. (6 marks)

(d) With the aid of sketches, illustrate the following types of equilibrium:

(i) stable;
(ii) unstable;
(iii) neutral.

(5 marks)

7. (a) An electric train moving at 20 km/hr accelerates to a speed of 30 km/hr in 20 seconds. Find the average acceleration in metres per second square (m/sec^2) and the distance travelled in metres during the period of the acceleration. (6 marks)

(b) The following results in table 2 were obtained when stretching a copper wire.

Table 2

FORCE (N)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.1	4.2
Length (mm)	500	500.5	501.0	501.5	502.0	504.0	516.0	525.0	573.0	597.0	610.0

(i) Plot the graph of load against extension. (4 marks)

(ii) Indicate the main features of the graph. (4 marks)

(c) In a pump station a plant operator found that a water pump lifts 200 kg of water through a vertical height of 6 m in 10 seconds. Calculate:

(i) work done;
(ii) power of the pump.

(6 marks)

8. (a) Explain **three** ways of reducing friction on surfaces. (6 marks)

(b) A light alloy consists of 70 percent aluminium and 30 percent magnesium by mass. Calculate its density given the densities of aluminium and magnesium are 2700 kg/m^3 and 1740 kg/m^3 respectively. (7 marks)

(c) Explain the following types of energy giving at least **one** example:

(i) renewable energy;
(ii) non renewable energy.

(3 marks)

(d) Show that pressure in fluids is given by:

$P = \rho hg$ where: ρ = density, h = height and g = gravitational force. (4 marks)

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