1704/102
MATHEMATICS I AND
PHYSICAL SCIENCE
Oct./Nov. 2017
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 table/Scientific calculator;
  Drawing instruments.
This paper consists of EIGHT questions in TWO sections; A and B.
Answer FIVE questions choosing at least TWO questions from section A and B and
ONE question from either section.
All questions carry equal marks.
Maximum marks for each part of a question are as shown.
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.

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SECTION A: MATHEMATICS

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

1. (a) A carpenter has four pieces of timber measuring 12 ft, 16 ft, 20 ft and 24 ft. He wants to cut equal pieces from them. Find the longest piece he can obtain. (3 marks)

   (b) Solve the equation

   $$3^{2x+1} = 5(3^x) - 1$$

   (8 marks)

   (c) Solve the simultaneous equations:-

   $$\log_{10}(x+y) = 3$$

   $$\log_x^3 + 3\log_{27}^y = 8$$

   (9 marks)

2. (a) If $y = \dfrac{WS^3}{d^4}$ transpose the formula to make S the subject. (3 marks)

   (b) The hourly wage bill for 17 craftsmen and 12 apprentices is Ksh. 1790. Another hourly wage bill for 10 craftsmen and 5 apprentices is 950. Find the hourly wage bill for each of them. (7 marks)

   (c) Blocks are used to build a single wall such that each row contains one less block than the row beneath. If the top row has one block and three dozen blocks are used altogether. Find the number of:-

   (i)   row there are;
   (ii) blocks in the bottom row.

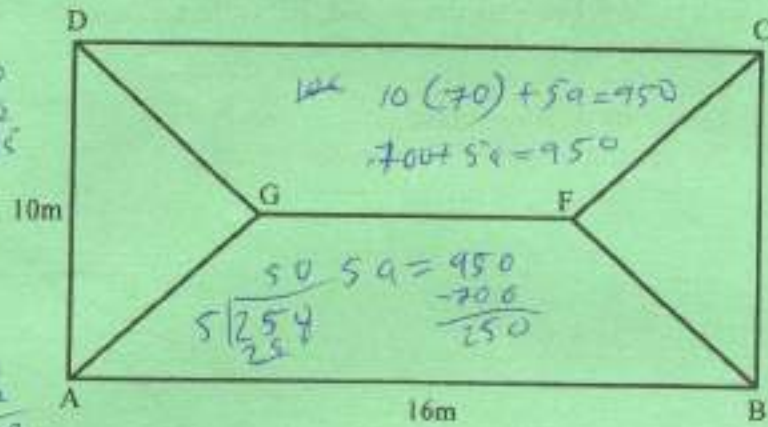   (10 marks)

3. (a) Calculate the area of a plot which is triangular in shape and whose sides are 58 m, 52 m and 28 m.

(4 marks)

(b) The base of a roof shown in the **figure 1** below is a rectangle ABCD. The equal faces ADG and BCF each makes an angle of 45° with the base. The equal faces ABFG and CDGF each makes an angle of 50° with the base.

Fig. 1

Calculate:

(i) the perpendicular height of the roof;

(ii) the length G F;

(iii) the length of the sloping edge AG.

(6 marks)

(c) Draw the graph of $y = x^3 - 3x + 1$ for values of $x = -1$ to $x = 4$. Use the graph to solve the equation $x^2 - 4x + 2 = 0$.

(10 marks)

4. (a) The data in the **table 1** below shows the diameters in centimeters of PVC pipes in a hardware.

Table 1

Diameter	2 - 6	7 - 11	12 - 16	17 - 21	22 - 26	27 - 31
Frequency	2	10	15	24	14	5

Calculate the:

(i) mean;

(ii) median.

(10 marks)

(b)   Prove the identify:

$$\frac{Cos\theta \tan\theta}{Sin\theta} - Cos^2\theta = Sin^2\theta$$

(3 marks)

(c)   **Figure 2** shows part of a J16 crane in form of a triangle ABC. AB is a vertical part 4 m high, with point A being on the ground, BC is the tie rope and AC is the J16 which is 8 m long. If the angle $\angle BAC$ is 40°. Find:

(i)   the length of the rope BC;
(ii)   the vertical height of C above the ground;
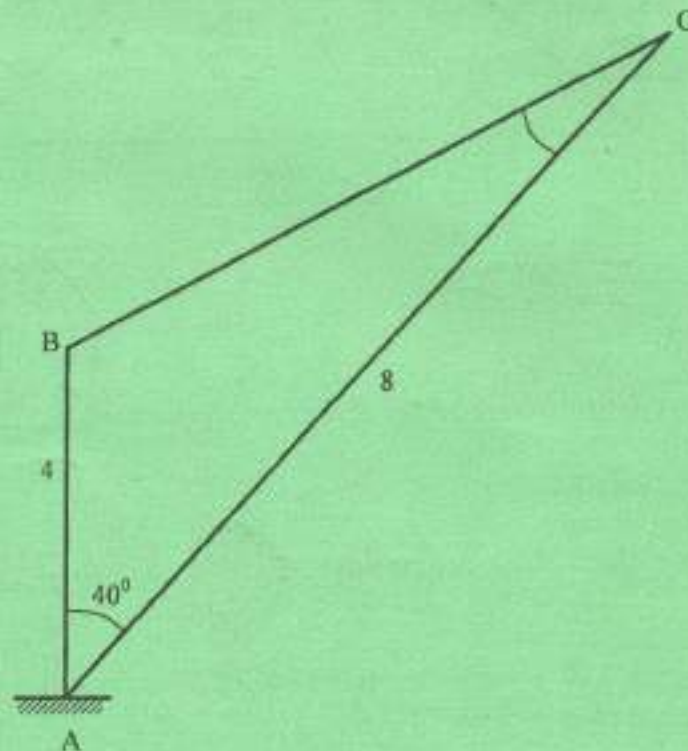(iii)   angle BCA.

(7 marks)

Fig. 2

SECTION B: PHYSICAL SCIENCE

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

5.   (a)   Explain the difference between a vector and a scalar quantity giving **one** example in each case.   (4 marks)

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

       (c)   Using a well balanced chemical equation. Explain **two** methods of salt preparation.   (6 marks)

       (d)   With the aid of a sketch explain the structure of an atom, hence explain the terms:

               (i)   atomic mass;
               (ii)   mass number.   (6 marks)

6.   (a)   Define the terms:

               (i)   moment of a force;
               (ii)   couple;
               (iii)   resultant force.   (4 marks)

       (b)   State **two** conditions for equilibrium.   (4 marks)

       (c)   State **two** factors affecting stability.   (2 marks)

       (d)   A uniform metre rule is freely pivoted at the 30 cm mark and balances horizontally when a mass 80 g is hung from the 2 cm mark. Draw a diagram of the metre showing all the forces acting on the meter rule. Calculate the mass of the metre rule.   (10 marks)

7.   (a)   Define the terms:

               (i)   work;
               (ii)   power;
               (iii)   energy.   (3 marks)

       (b)   State the law of conservation of energy.   (2 marks)

       (c)   (i)   Differentiate between potential energy and kinetic energy.   (4 marks)

               (ii)   State **four** forms of energy.   (4 marks)

(d) Define the terms:

(i)   stress;
(ii) strain;
(iii) modulus of elasticity.

(7 marks)

8. (a) Define the terms:

(i)   pressure;
(ii) density;
(iii) relative density.

(3 marks)

(b) **Figure 3** shows a block with mass 2.5 kg which rest on a ramp. If the coefficient of static friction between the block and the ramp is 0.350, what is the maximum angle the ramp makes with the horizontal before the block starts to slip down.   (6 marks)
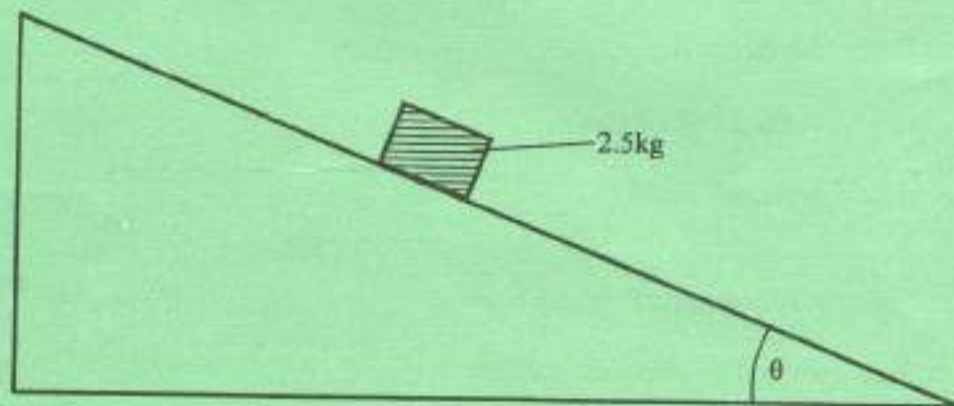

Fig. 3

(c) With aid of a sketch explain how Archimedes principle can be proved.   (5 marks)

(d) State **three** advantages and **three** disadvantages of friction.   (6 marks)

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