

1704/102  
MATHEMATICS I AND PHYSICAL SCIENCE  
June/July 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 TWO questions from section A, TWO questions from section B 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.**

**SECTION A: MATHEMATICS I**

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

1. (a) Evaluate without using mathematical tables.

(i)  $\log_3 24^2$ . (4 marks)

(ii)  $\log_{10} 125 + \log_{10} 8$ . (4 marks)

(b) Solve  $4^{2x-1} = 8^{x+3}$ . (4 marks)

(c) Make  $y$  the subject of the formula, then find the value of  $y$  in  $m = 5y - n^2$  when  $m = 1$ ,  $n = -3$ . (4 marks)

(d) Solve the following simultaneous equations:

$2x + 5y = -11$   
 $x - y = 5$

$1(2x + 5y = -11)$   
 $2(x - y = 5)$

$2x + 5y = -11$   
 $-2x - 2y = 10$   


---

 $0 - 7y = -21$

$-7y = -21$   
 $y = 3$   
 $2x + 5y = -11$   
 $2x + 5(3) = -11$   
 $2x + 15 = -11$   
 $2x = -11 - 15$   
 $2x = -26$   
 $x = -13$

(a) The base of a regular pyramid is 6 cm by 8 cm and its height is 14 cm. Find the total surface area and volume of the pyramid. (14 marks)



(b) Calculate the area of the shaded segment in the figure 1 below; (6 marks)

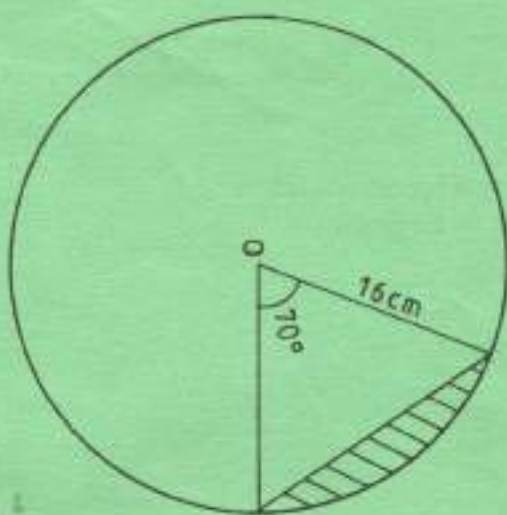


Figure 1

$2(2) + 5(-3) = -11$   
 $4 - 15 = -11$   
 $-11 = -11$

1d)  $2x + 5y = -11$   
 $x - y = 5$

$1(2x + 5y = -11)$   
 $5(x - y = 5)$

$2x + 5y = -11$   
 $-5x - 5y = 25$   


---

 $-3x$

$7(2x + 5y = -11)$   
 $2x(5x - 4y = 5)$

$2x + 5y = -11$   
 $-2x - 10 = 10$   


---

 $0 - 5y = 1$



3. The following are the marks scored by 40 students in an examination:

55	82	92	75	67	66	71	81
63	90	89	72	68	54	62	88
77	52	51	52	61	78	63	54
69	88	82	90	72	56	80	73
90	61	87	74	86	60	64	87

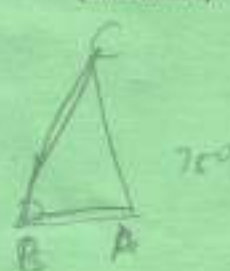
- (a) Find the mode and the range;  
 (b) make a frequency distribution table, starting with 50-54...;  
 (c) calculate the mean;  
 (d) calculate the standard deviation.
- (a) Calculate the lengths, angles and the area of the triangle ABC, where AC=21 cm and angle ABC = 78°.  
 (b) Solve  $7 \cos x - 5 \sin x = 6$  for  $0 \leq x \leq 360^\circ$ .

$a^2 + b^2 = c^2$   
 $a^2 + 3^2 = 4^2$   
 $a^2 = 16 - 9$   
 $a^2 = 7$   
 $a = \sqrt{7}$   
 $2.64$   
 $2.65$

55-59  
 60-64  
 65-69  
 70-74  
 75-79  
 80-84  
 85-89  
 90-94  
 95-99

117/1016 2017  
 (20 marks)  
 (10 marks)  
 (10 marks)

$(6 \times 8 \times 14) \div 2$   
 $1,344 \div 2$

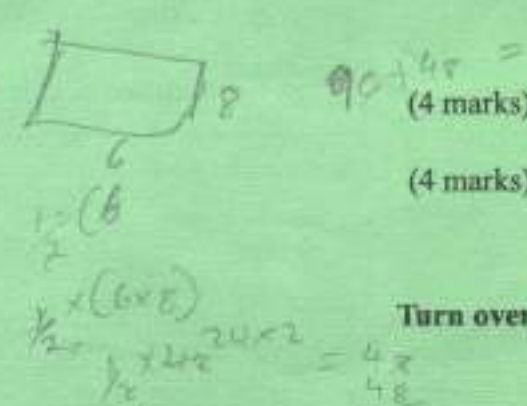


**SECTION B: PHYSICAL SCIENCE**  
 Answer at least **TWO** questions from this section.

5. (a) Define the following:
- (i) acid;
  - (ii) base;
  - (iii) acid salt.
- (b) By use of appropriate equations, explain **three** methods of salt formation.
- (c) State **two** properties of:
- (i) acids;
  - (ii) bases.
- (d) Describe the term self-ionization of water.

$\frac{1}{2}(bh)^2 + \frac{1}{2}(bh)^2 \rightarrow 2 \times w$   
 $\frac{1}{2}(L \times w) \times H$

$a - c =$   
 $2 - b = c$



6. (a) Explain the meaning of the following terminologies:
- stress;
  - strain;
  - modulus of elasticity. (6 marks)
- (b) State Hooke's law of elastic materials. (2 marks)
- (c) A metal wire is 2.5 mm diameter and 2 m long. A force of 12 N is applied to it and it stretches 0.3 mm. Assuming the material is elastic, determine the following:
- the stress in the wire  $\delta$ . (4 marks)
  - the strain in the wire  $\epsilon$ . (2 marks)
- (d) A steel column is 3 m long and 0.4 m diameter. It carries a load of 50 MN. Given that the modulus of elasticity is 200 GPa, calculate:
- the compressive stress;
  - the strain and determine how much the column is compressed. (6 marks)
7. (a) List two states of matter. (1 mark)
- ✗(b) State three differences between physical and chemical changes. (3 marks)
- ✗(c) State Newton's laws of motion. (6 marks)
- (d) The density of iron is 7700 kg/m<sup>3</sup>, calculate:
- its relative density;
  - the mass of a rod of iron 60 cm long and 10 cm in diameter. (7 marks)
- (e) State the law of conservation of energy. (3 marks)
8. (a) Define the following:
- distance; ~~the displacement of~~ <sup>displacement of</sup>
  - displacement;
  - velocity. (3 marks)
- (b) An aeroplane lands at a velocity of 50 ms<sup>-1</sup> and decelerates at 20 ms<sup>-2</sup> to a velocity of 20 ms<sup>-1</sup>. Calculate the distance travelled on the runway. (5 marks)
- (c) Show that displacement for a particle moving in a straight line is given by the equation  $s = ut + \frac{1}{2}at^2$  where  $s$  = displacement,  $t$  = time,  $u$  = initial velocity and  $a$  = acceleration. (5 marks)



- (d) (i) Calculate the work done when a force of 5 kN moves its point of application 600 mm in the direction of the force. (3 marks)
- (ii) A constant force of 2 kN pulls along a level floor for a distance of 10 m in 50 s, determine the power used. (4 marks)

THIS IS THE LAST PRINTED PAGE.

$$2a) \text{ S.A.} = \frac{1}{2} (b_1 + b_2) \times h$$

$$\frac{1}{2} (6 \times 8 + 14) \times 14 + (6 \times 8)$$

$$\frac{1}{2} (6 + 14) \times 14 + 6 \times 8$$

$$1,344 + 48$$

$$\text{S.A.} = 1,392 \text{ cm}^2$$

$$\text{Volume} = \frac{1}{3} (b_1 + b_2) \times h$$

$$\frac{1}{3} (6 + 14) \times 14$$

$$= \frac{1}{3} (48) \times 14$$

$$= 224 \text{ cm}^3$$

$$2b) \frac{1}{2} \times 16 \times 16 \sin 70$$

$$120.28$$

$$\frac{\pi}{360} 2r^2$$

$$\frac{70}{360} \times \pi \times 16 \times 16$$

$$156.38$$

$$156.38 - 120.28$$

$$= 36.10 \text{ cm}^2$$

