Name ..... Index Number .....

Candidate's Signature .....

Date .....

232/3
PHYSICS
(PRACTICAL)
Paper 3
Nov. 2016
2½ hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
PHYSICS
(PRACTICAL)
Paper 3
2½ hours

Instructions to candidates

(a) Write your name and index number in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above.
*(c) Answer **ALL** the questions in the spaces provided in the question paper.*
(d) You are supposed to spend the first 15 minutes of the 2½ hours allowed for this paper reading the whole paper carefully before commencing your work.
(e) Marks are given for a clear record of the observations actually made, their suitability, accuracy and the use made of them.
(f) Candidates are advised to record their observations as soon as they are made.
*(g) **Non-programmable** silent electronic calculators **and** KNEC mathematical tables may be used.*
*(h) **This paper consists of 10 printed pages.***
*(i) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
*(j) **Candidates should answer the questions in English.***

For Examiner's Use Only

Question 1

	e	f	g	i	j	o	p	q	r
Maximum Score	3	3	4	4	1	2	1	1	1
Candidate's Score									

Total [ ]

Question 2

	c	d	e	f	g	h	i
Maximum Score	2	1	2	6	4	3	2
Candidate's Score							

Total [ ]

Grand Total [ ]

1. You are provided with the following:

- A triangular glass prism
- A piece of soft board
- Four optical pins
- Four office pins
- A sheet of plain paper
- A voltmeter
- An ammeter
- A galvanometer
- Two cells and two cell holders
- A resistance wire mounted on a metre rule with the ends marked F & H
- A copper wire labelled C
- A resistance wire labelled R
- A switch
- Connecting wires
- A glass tube

PART A

Proceed as follows:

(a) Place the plain sheet of paper on the soft board and pin it using the office pins at the corners. Trace the triangular prism outline of the prism on the sheet of paper (use the upper part to leave space for two other outlines on the same page). Label the vertices of the outline at A, B and C. Remove the prism from the paper.

(b) On the outline at a point O near the centre of side AB draw a normal ON.

(c) Draw a line PO at an angle of 30° to the normal ON as shown in **Figure 1**.

(d) Replace the prism accurately on the outline. Fix two optical pins vertically on line PO at different points (**see Figure 1**).

(e) View the images of the two pins through side AC of the outline. Fix a third and fourth pin vertically such that they are in line with the images of the first and second pin. Remove the prism and the pins. Draw a line joining the marks made by the third and fourth pins and extend it to join line PO (also extended) as shown in **Figure 1**.

(1 mark)

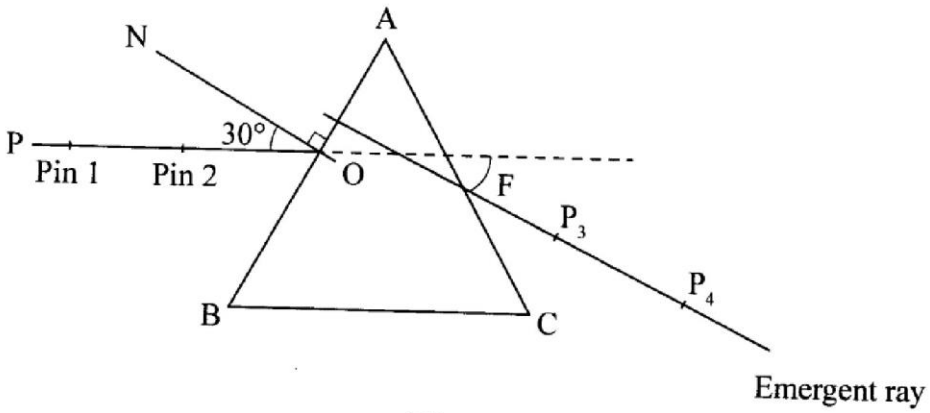

Figure 1

Measure F, the angle of deviation of the emergent ray. (2 marks)

(f) Repeat part (e) for other angles of incidence shown in **Table 1**. (Draw a fresh outline of the prism for each angle of incidence)

Complete table 1 (3 marks)

Table 1

Angle of incidence	30°	50°	70°
Angle of deviation			

(g) Determine:

(i) E the angle of emergence (between the emergent ray and the normal at the point of emergence) at the least angle of deviation. (2 marks)

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(ii) K given that $K = 2 \sin \left(\frac{30 + F_0}{2} \right)$ (where F_0 is the least angle of deviation). (2 marks)

(Attach the plain sheet of paper to your question paper and hand them in).

PART B

Proceed as follows:

Set up the circuit shown in **Figure 2**.

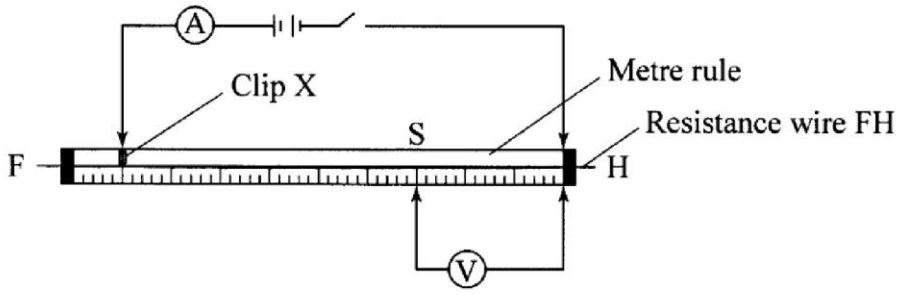

Figure 2

(S is a point on wire FH such that SH = 30 cm).

(h) Close the switch. Adjust the position of Clip X along FH until the current is 0.2A. Record the potential difference (V) across length SH in **Table 2**.

(i) Repeat part (a) for the values of current in **Table 2**.

Complete Table 2 (4 marks)

Table 2

Current I (A)	0.2	0.3	0.4
Potential difference V(v)			
Resistance $R = \frac{V}{I}$ (Ω)			

(j) Determine **Rm**, the mean resistance of wire SH. (1 mark)

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(k) Open the switch, disconnect the voltmeter and remove the cells.

(l) Using a glass rod, wind the copper wire (C) into a coil. Slightly pull out the ends to ensure that adjacent turns of the coil do not touch.

(m) Join the coil to the resistance wire R by winding about 1 cm of the coil end onto one end of resistance wire R (see **Figure 3**).

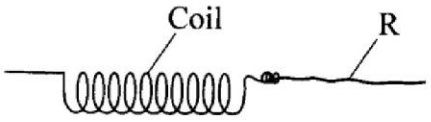

Figure 3

(n) Set up the circuit as shown in **Figure 4**.

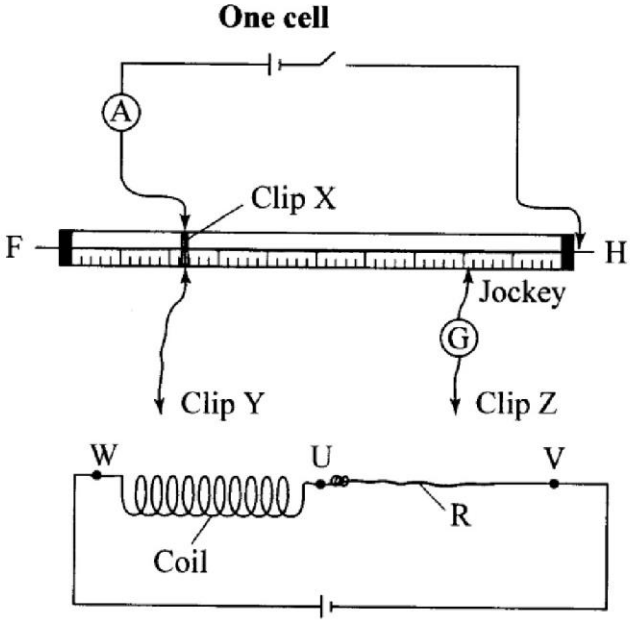

Figure 4

Close the switch and adjust clip X to a point O along FH so that the current is now 0.1A. Record the centimetre mark of point O.

Centimetre mark of point O ..... cm.

(o) Move the jockey along OH and obtain a point T, where the galvanometer reads zero. Record the centimetre mark of T_1

Centimetre mark of T_1 ..... cm (1 mark)

Determine length **Lc** of OT_1

Lc = ... (1 mark)

(p) Connect clip Y at U and clip Z at V and repeat part (h) to obtain the point T_2 (where the galvanometer reads zero), the balance point of wire R.

Record the centimetre mark of T_2 for R.

Centimetre mark of T_2 = ... cm (1 mark)

(q) Determine the balance length L_R for the resistance wire R.

L_R = ... (1 mark)

(r) Determine the constant R_C given that:

$$R_C = \frac{L_C}{L_R} \bullet \frac{R_M}{3}$$ (1 mark)

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2. You are provided with the following:

- Two half metre rules
- One metre rule
- One stopwatch
- Two pieces of thread
- Some sellotape
- Stand boss and clamp

Proceed as follows:

(a) Using the retort stand, clamp one half-metre rule at its centre, such that the scale is horizontal in a vertical plane (see **Figure 5**). Using sellotape and two strings, suspend the second half-metre rule in a horizontal plane such that;

(i) its scale is horizontal

(ii) the strings are equidistant from the centres of the half-metre rules and distance $d_1 = 40\,cm$ apart.

(iii) The height between the two half-metre rules is L = 65 cm. (see **Figure 5**).

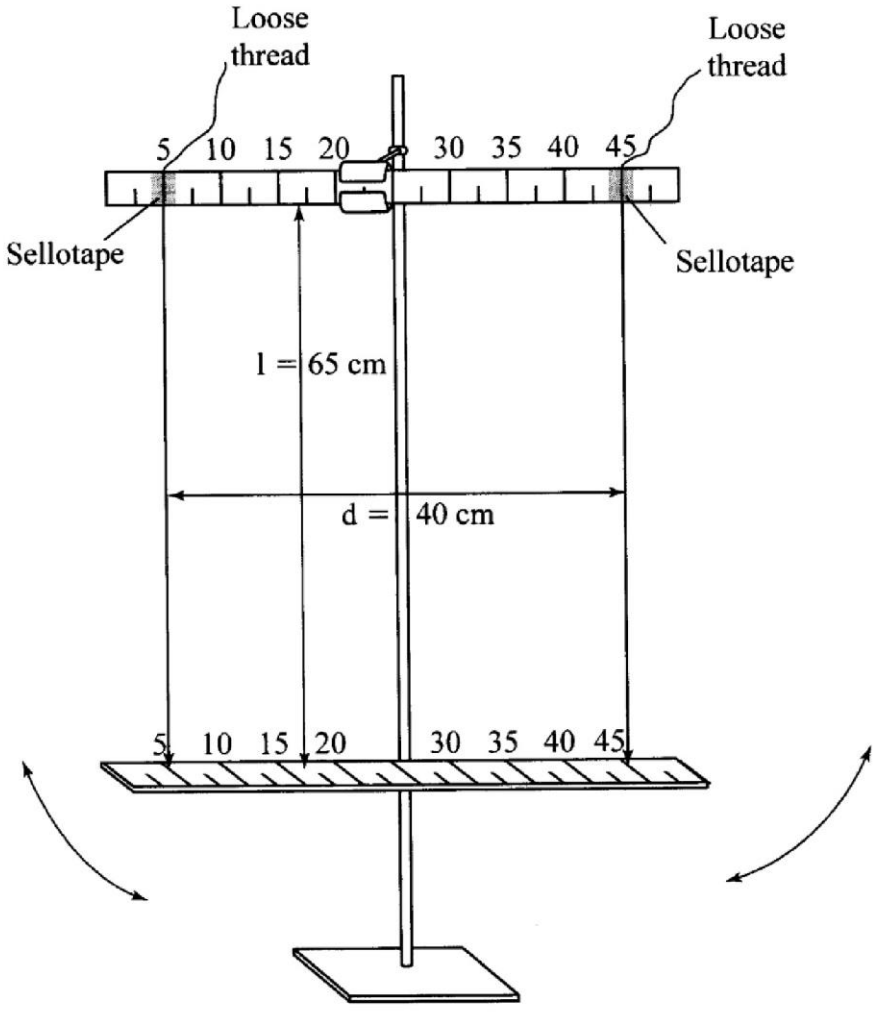

Figure 5

(b) Set the suspended rule into small oscillations in a horizontal plane about a vertical axis through its centre. (see **Figure 5**).

(c) (i) using the stopwatch, record the time t, for oscillations.

t_1 = ... s (1 mark)

(ii) Determine the period T, the time for one oscillation.

T_1 = ... (1 mark)

(d) With l still at 65 cm, change the distance between the strings from 40 cm to d_2 = 20 cm. Repeat part C to obtain period T_2.

T_2 = ... (1 mark)

(e) Determine constant r given that (2 marks)

$$r = \frac{\log(T_1/T_2)}{\log(d_1/d_2)}$$

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For the rest of the experiment the distance between the strings should remain 20 cm.

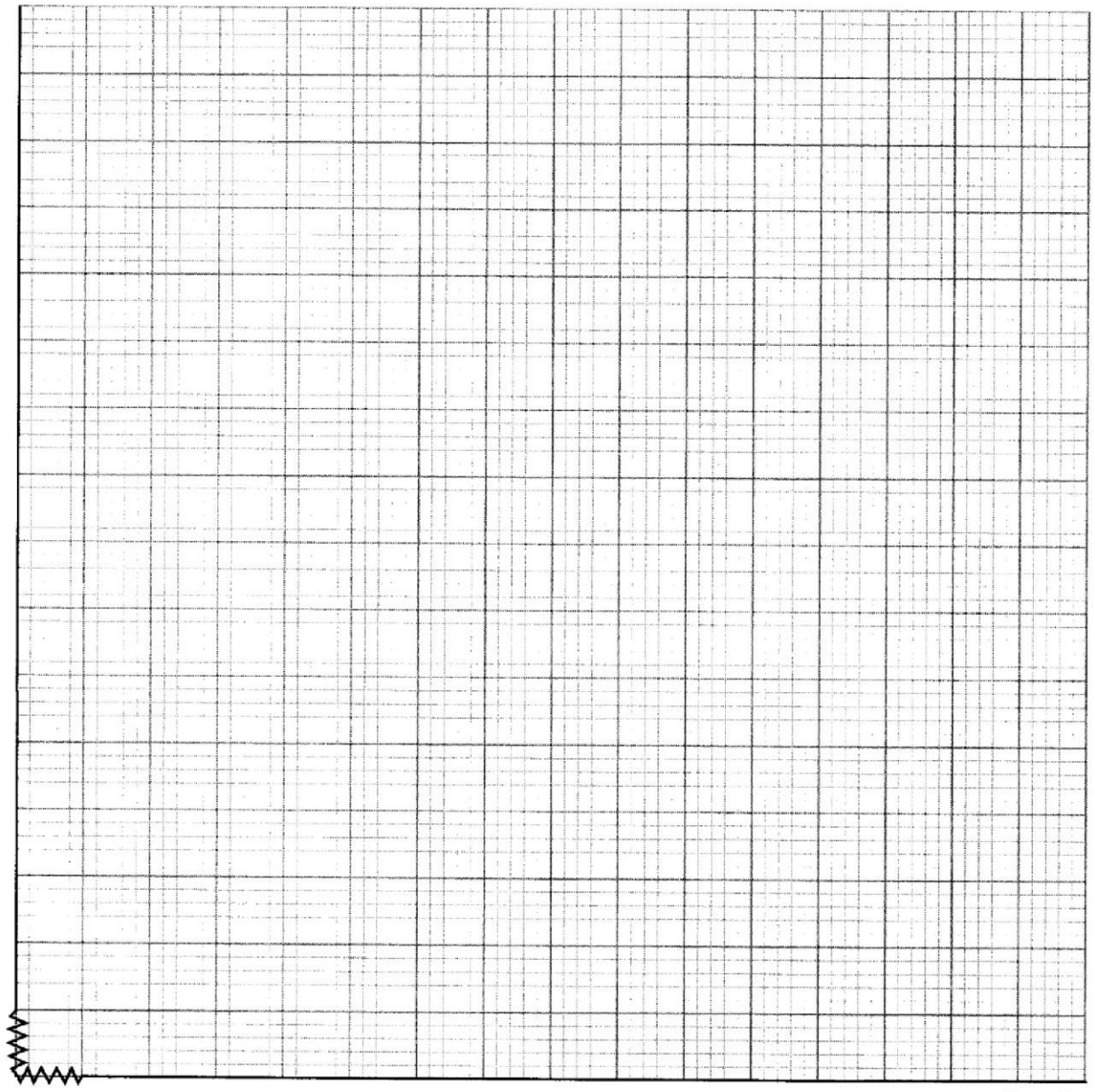
(f) Repeat part (c) for values of *l* Shown in **Table 3**. Complete **Table 3** (6 marks)

Table 3

Length *l* cm	60	55	50	45	40	35
time for 20 oscillations t(s)						
Period T (s)						
log T						
log L						

(g) Plot a graph of log T (*y* axis) against Log L (4 marks)

Log T



Log L

(h) Determine the S of the graph (3 marks)

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(i) Given that the time t for N oscillations is given by $t = KNL^{s}D^{r}$ where K is a constant, deduce an expression for the period T in terms of l and d with s and r correct to 1 decimal place. (2 marks)

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