THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

232/3

Paper 3

PHYSICS – (Practical)

Dec. 2022 – 2½ hours

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

Candidate's Signature ..... **Date** .....

Instructions to candidates

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(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 made, their suitability, accuracy and use.
(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

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	b	c	d	e	f
Maximum Score	3	4	5	5	3
Candidate's Score					

Total ☐

Question 2

	b	c	e	h	i	l	m
Maximum Score	4	6	4	2	1	1	2
Candidate's Score							

Total ☐

Grand Total ☐

317149

QUESTION 1

You are provided with the following:

- A metre rule
- A candle
- A plain white screen labelled S_2
- A white screen with cross-wires labelled S_1
- A lens mounted on a lens holder

Proceed as follows:

PART A

(a) (i) Arrange the candle, the screen S_1, the lens and the plain screen S_2 in that order as shown in **Figure 1**.

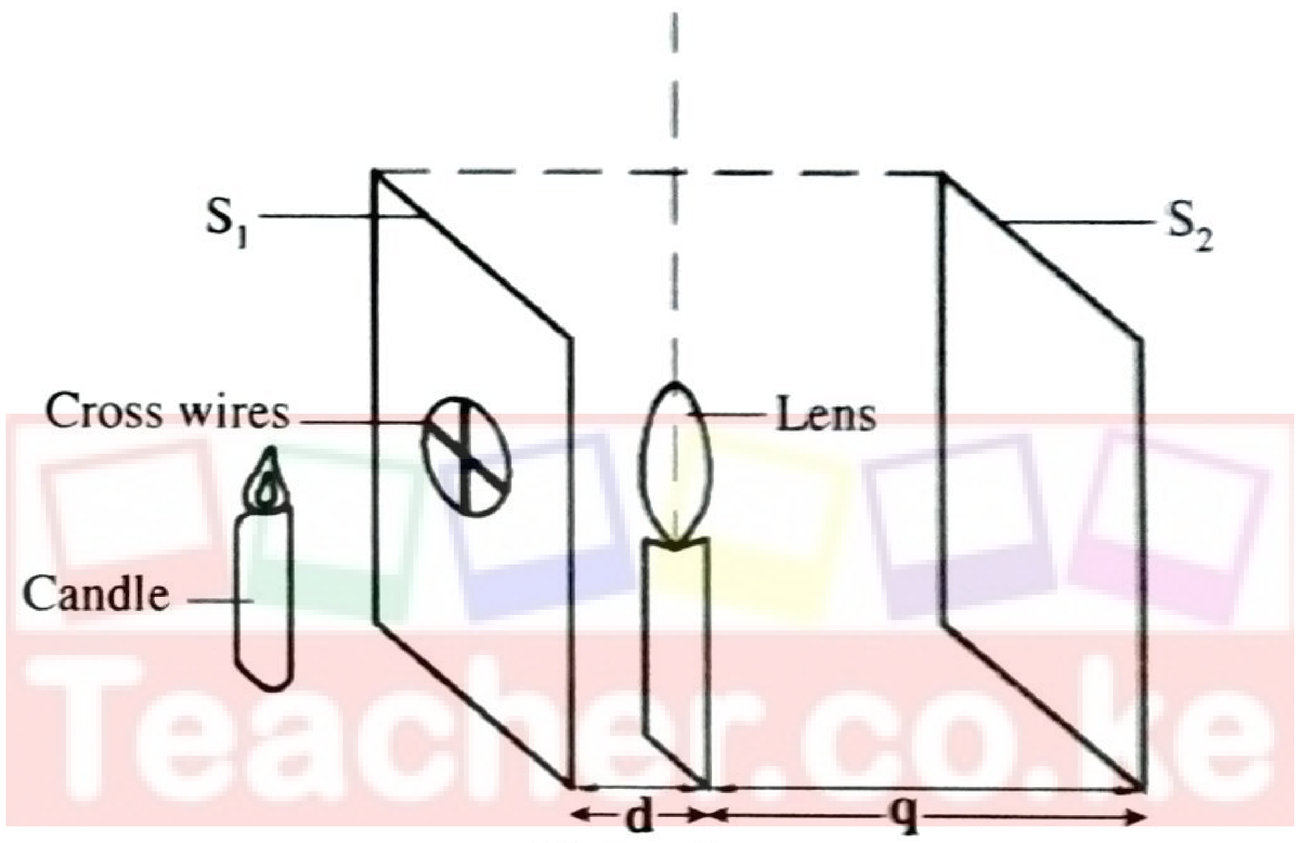

Figure 1

(ii) Light the candle. Ensure that the candle flame is close to the cross-wire and it is in a horizontal line with the centres of the lens and the screens.

(b) Set the distance **d** between the cross-wires and the lens at **d** = 16 cm. Adjust the distance **q** between the lens and the screen S_2 so that a sharp image of the cross-wires is formed on Screen S_2.

(i) Record the distance **q**.

q = ... cm (1 mark)

(ii) Determine h given that: $h = \frac{16q}{q+16}$ (2 marks)

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(c) Place screen S_2 aside and adjust the position of the lens until a sharp image of the flame is formed on the screen beside the cross-wires.

(i) Measure the distance x between the screen S_1 and the lens.

$x =$ ..... cm (1 mark)

(ii) Determine r given that: $r = \frac{xh}{x-h}$ (2 marks)

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(ii) Determine m given that: $\frac{r}{h} = 2(m-1)$ (1 mark)

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(d) Place the plain screen S_2 back to its original position as in **Figure 1**. Set the distance **d** between the cross-wires and the lens at **d** = 14 cm.

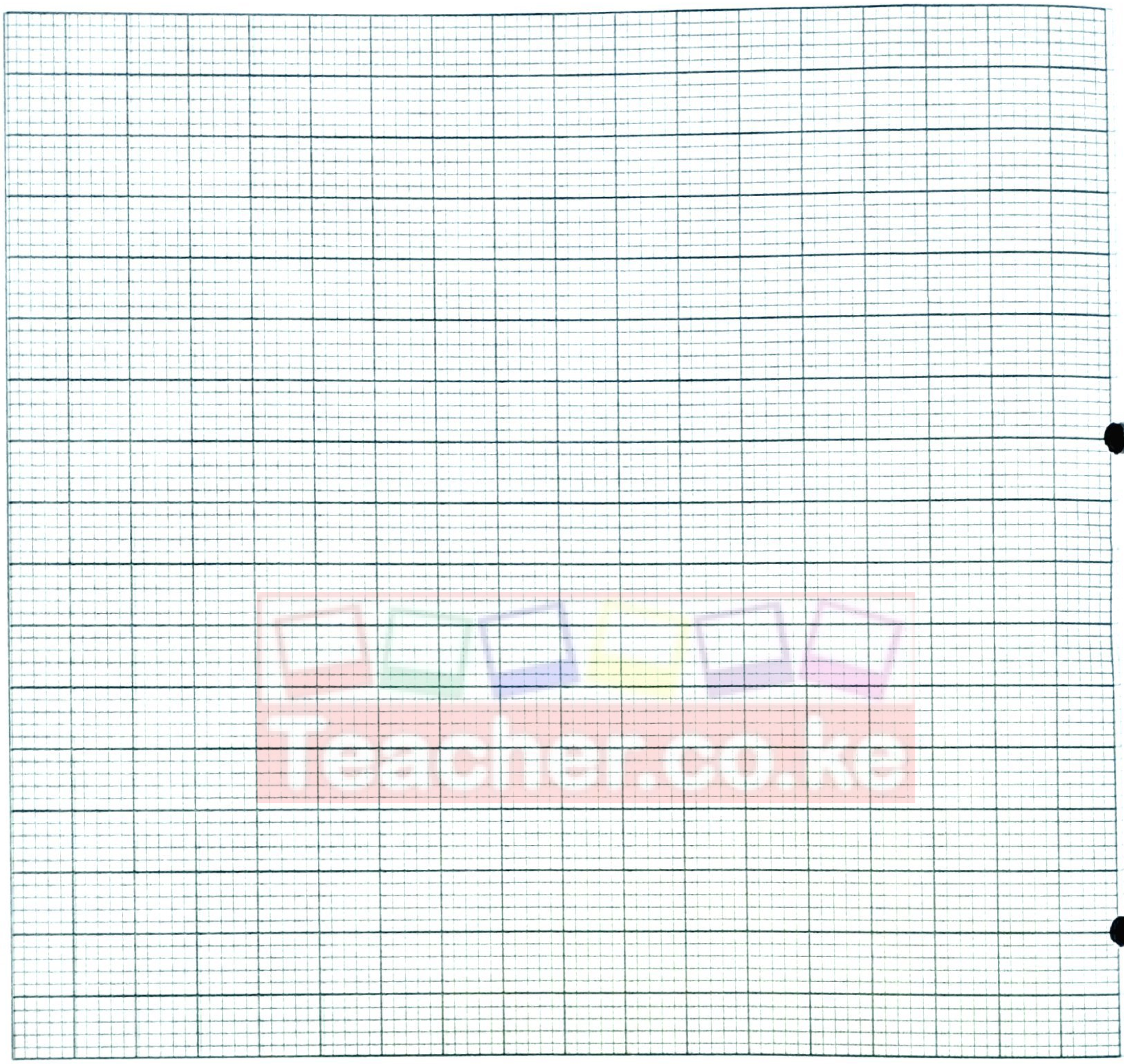
(i) Adjust the position of the plain screen S_2 to obtain a sharp image of the cross-wire. Measure the distance **q** between the image and the lens. Record the distance **q** in **Table 1**

(ii) Repeat part (d)(i) for other values of **d** shown in **table 1** and complete the **table**. (5 marks)

Table 1

d (cm)	14	15	18	21	24	30	35
q (cm)							
S = **d** + **q** (cm)							

(e) Plot a graph of S (y-axis) against q. (5 marks)



(f) From the graph, determine the:

(i) minimum distance S_0 between the object and its real image (1 mark)

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(ii) focal length f given that: $f = \frac{S_0}{4}$ (1 mark)

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(iii) image distance v when S is minimum (1 mark)

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QUESTION 2

You are provided with the following:

- A piece of thread
- A metre rule
- A triangular glass prism
- A 50 g mass
- A boss, a clamp and a stand
- Some water in a beaker
- Some tissue paper
- Liquid **L**
- An ammeter
- A voltmeter
- A wire labelled **P**
- A wire labelled **Q**
- A switch
- Two dry cells
- 9 connecting wires
- A wire mounted on a metre rule labelled **AB**
- A centre zero galvanometer
- A jockey

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Proceed as follows:

PART A

(a) Using a piece of thread, a clamp and a stand, suspend the metre rule so that it balances horizontally about its centre of gravity.

(b) On the metre rule, suspend the glass prism at the 70 cm mark and the 50 g mass at a distance X cm from the Centre of Gravity (CoG) so that the metre rule balances horizontally as shown in **Figure 2.**

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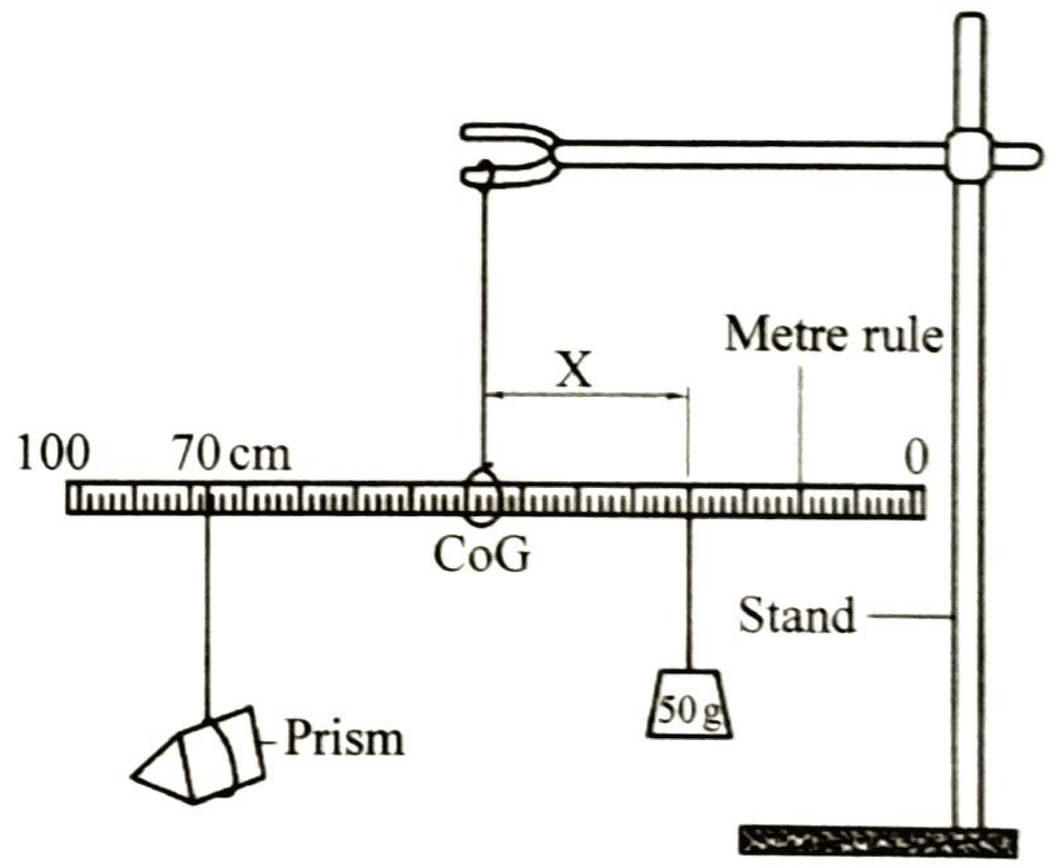

Figure 2

Maintain the prism at the 70 cm mark throughout the experiment.

(i) Record the balance length X.

X = ... cm (1 mark)

(ii) Using the principle of moments, determine the mass M_o of the prism. (3 marks)

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(c) While maintaining the position of the prism on the metre rule, lower the clamp to adjust the height of the prism until it is fully submerged in water as shown in **Figure 3.**

Ensure that the prism does not touch the sides of the beaker.

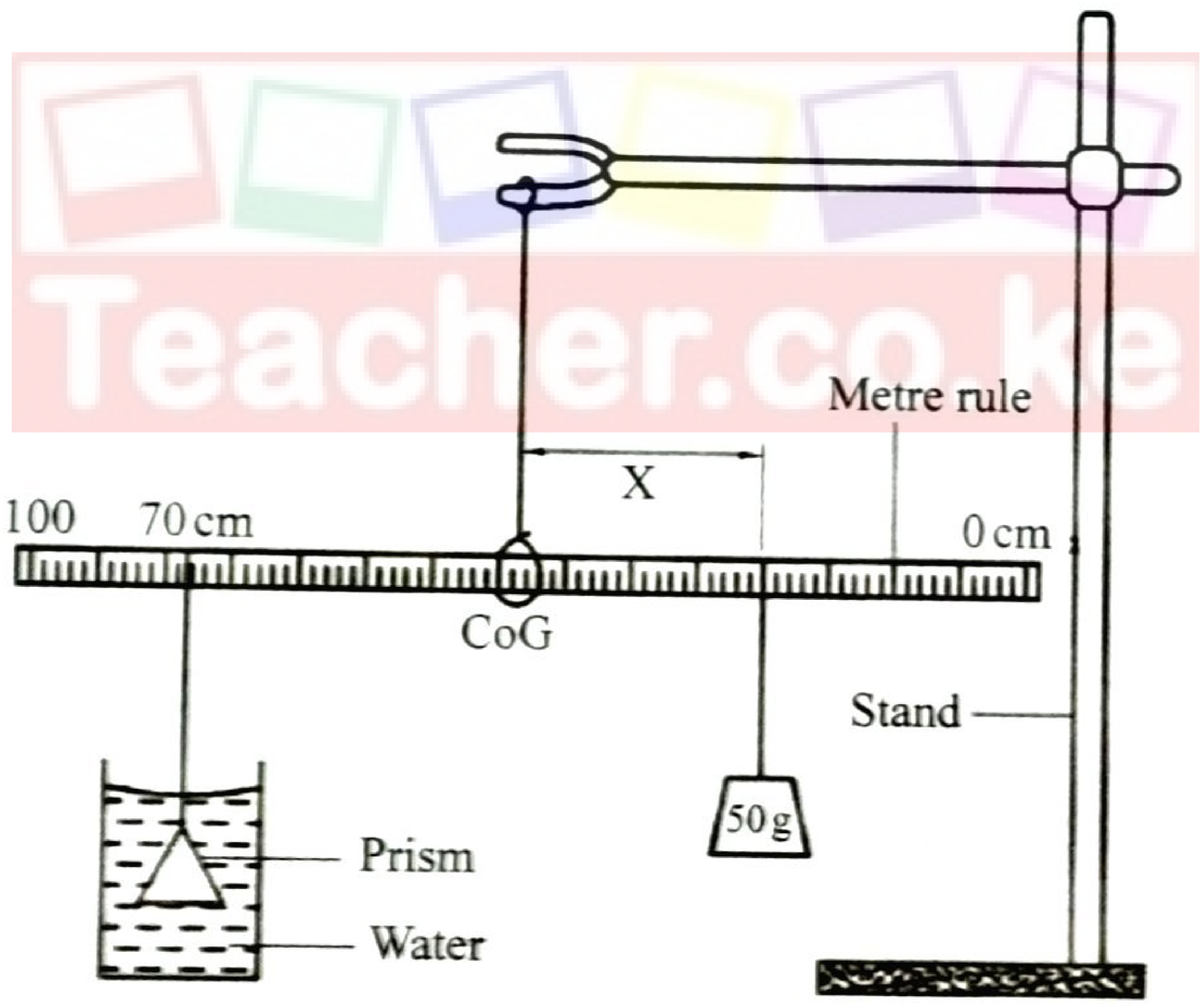

Figure 3

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(d) Adjust the distance X to restore the balance of the metre rule.

(i) Record the new balance length X_1.

X_1 = ... cm (1 mark)

(ii) Using the principle of moments, determine the apparent loss in mass M_1 of the prism in water. (3 marks)

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(iii) Determine the value of μ given that: $M_1 = M_0 - \mu$. (1 mark)

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(iv) State the quantity represented by μ. (1 mark)

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(e) Using tissue paper, dry the prism. Replace the water with liquid L and repeat the procedure in part (c) and adjust the distance X to restore the balance of the metre rule.

(i) Record the new balance length X_2.

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X_2 = ... cm (1 mark)

(ii) Given that $X = \dfrac{RX_1 - SX_2}{R - S}$, where $S = 1000\,\text{kgm}^{-3}$, determine the quantity R and state its SI unit. (3 marks)

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PART B

(f) Use the apparatus provided to set up the circuit shown in **Figure 4.**

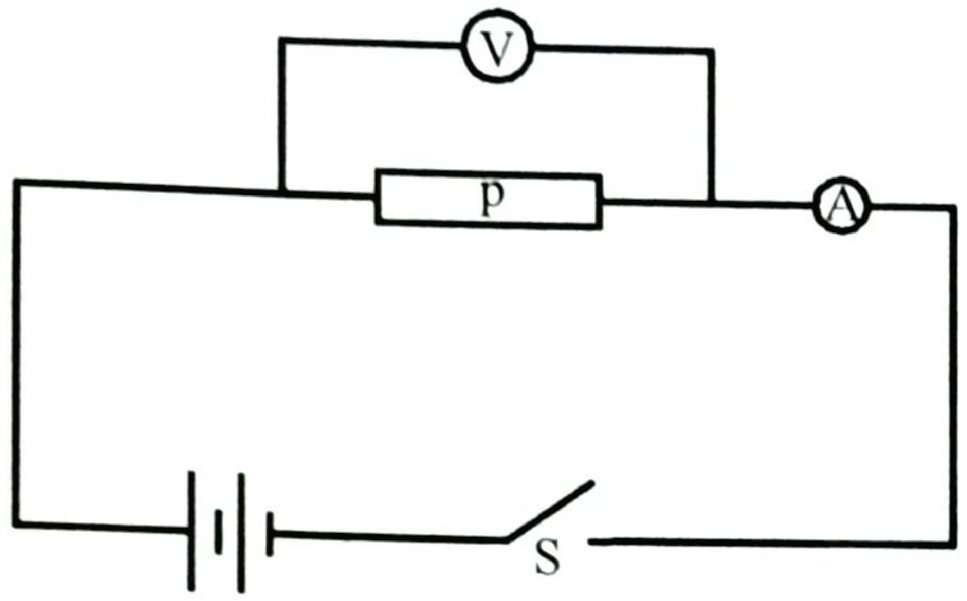

Figure 4

(g) Close the switch S.

(h) Read and record:

(i) Current I = ... (A) (1 mark)

(ii) Voltage V = ... (V) (1 mark)

(i) Determine resistance of P. (1 mark)

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(j) Disconnect the circuit in **Figure 4** and use the apparatus to connect the circuit in **Figure 5**.

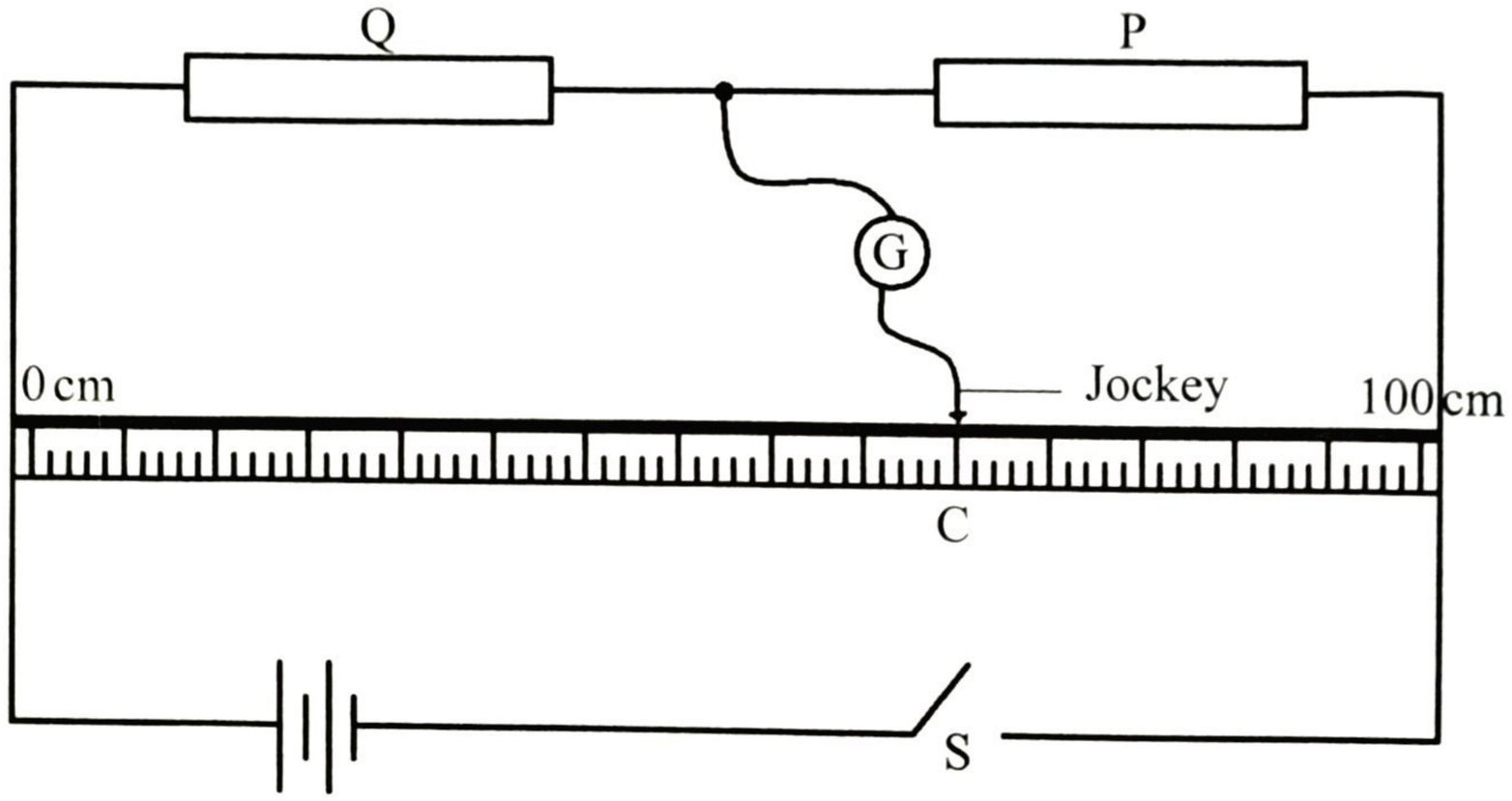

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Figure 5

(k) Close the switch S. Using the jockey tap the wire AB at various points to obtain point C where the galvanometer shows zero deflection.

(l) Record the balance length $AC = L$

$L =$ ..... cm (1 mark)

(m) Determine the resistance of Q. Given that $\frac{Q}{L} = \frac{P}{100 - L}$ (2 marks)

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