

P510/3
PHYSICS
PRACTICAL
Paper 3
3¼ hours

Uganda Advanced Certificate of Education

PHYSICS PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer Question 1 and one other question.

*Candidates are **not** allowed to start working with the apparatus for the first **15 minutes**.*

Marks are given mainly for a clear record of the observations actually made, for their suitability and accuracy, and for the use made of them.

Candidates are expected to record their observations as soon as they are made. Whenever possible, candidates should put their observations and calculations in a suitable table drawn in advance.

Details on the question paper should not be repeated in the answer and an account of the method of carrying out the experiment is not required.

Graph papers are provided.

Silent non-programmable calculators may be used.

1. In this experiment, you will determine:
- the constant, g due to gravity, and
 - the constant, β of the dry cell provided.

(40 marks)

PART I

- Clamp the spiral spring firmly from a retort stand using the pieces of wood provided.
- Set up the apparatus as shown in figure 1.1 with the thread and knife edge at the 2.0 and 48.0 cm marks respectively of the half-metre rule Q .
- Adjust the half-metre rule, Q , before loading it with the dry cell and mass m , such that it is horizontal.

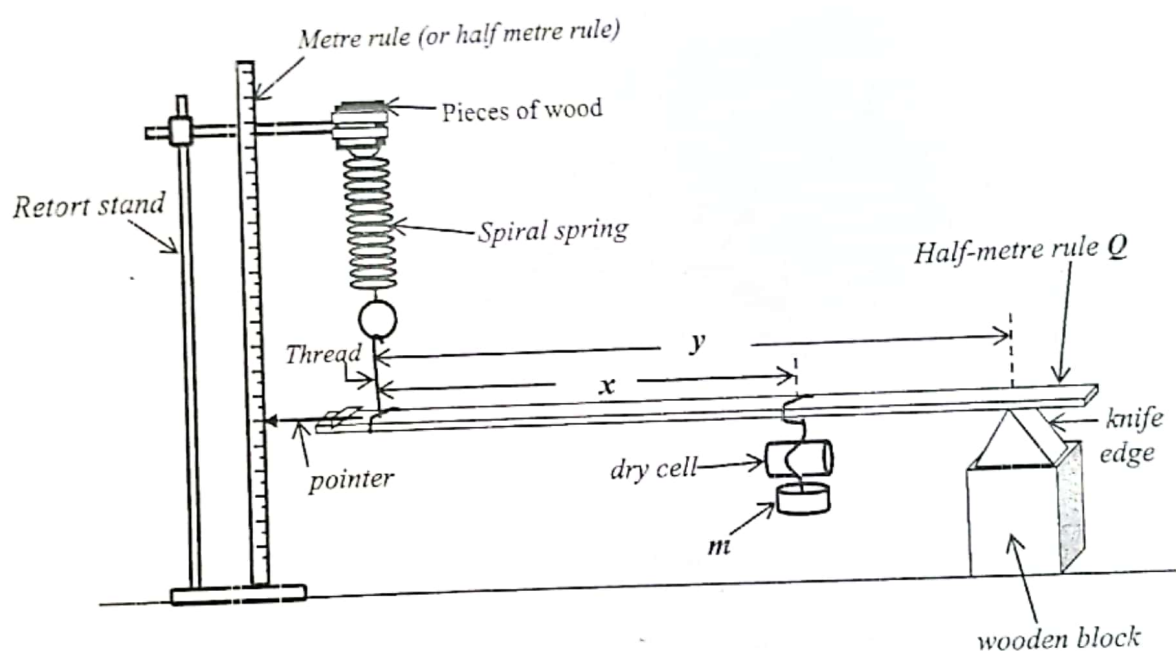


Fig. 1.1

- Measure and record the distance, y and the initial pointer position, P_0 on a vertical scale.
- Suspend the dry cell provided together with the mass $m = 0.100$ kg from the half-metre rule Q at a distance, $x = 30.0$ cm.
- Read and record the new pointer position, P_1 .
- Find the extension, e , of the spring, in metres.
- Repeat procedures (e) to (g) for values of $x = 25.0, 20.0, 15.0, 10.0$ and 5.0 cm.
- Tabulate your results including values of $\frac{1}{e}$ and $\frac{y}{(y-x)}$.

- j) Plot a graph of $\frac{1}{e}$ against $\frac{y}{(y-x)}$.
- k) Find the slope, S , of the graph.
- l) Dismantle the set up.

PART II

- a) Read and record the mass, M , of the dry cell, in kilograms.
- b) Clamp the spiral spring firmly from a retort stand using the pieces of wood as shown in figure 1.2.

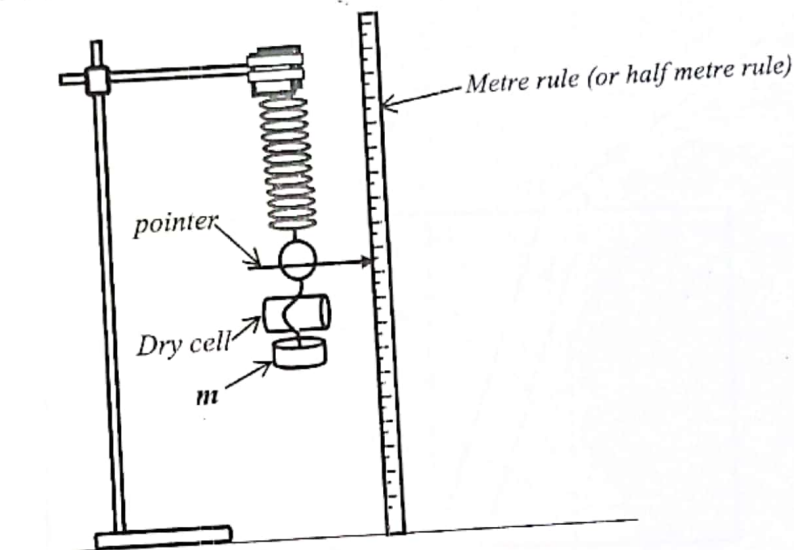


Fig. 1.2

- c) Suspend the dry cell together with the mass, m equal to $m_1 = 0.100$ kg from the lower end of the spring.
- d) Pull the mass m vertically downwards through a small distance and release it.
- e) Determine the time, t_1 for 20 oscillations.
- f) Calculate the period, T_1 .
- g) Calculate g from the expression: $g = \frac{4\pi^2}{ST_1^2}$
- h) Repeat procedure (c) and (d) for mass m equal to $m_2 = 0.200$ kg.
- i) Determine the time, t_2 for 20 oscillations.
- j) Calculate the period, T_2 .
- k) Calculate the constant, β , from the expression:

$$\beta = \frac{m_2 T_1^2 - m_1 T_2^2}{T_2^2 - T_1^2}$$

2. In this experiment, you will determine the constant, θ of the glass block provided using two methods. (40 marks)

METHOD I

- a) Fix the white sheet of paper on the soft board using drawing pins.
- b) Place the glass block in the middle of the paper with its broadest face uppermost and trace its outline ABCD as shown in figure 2.1.

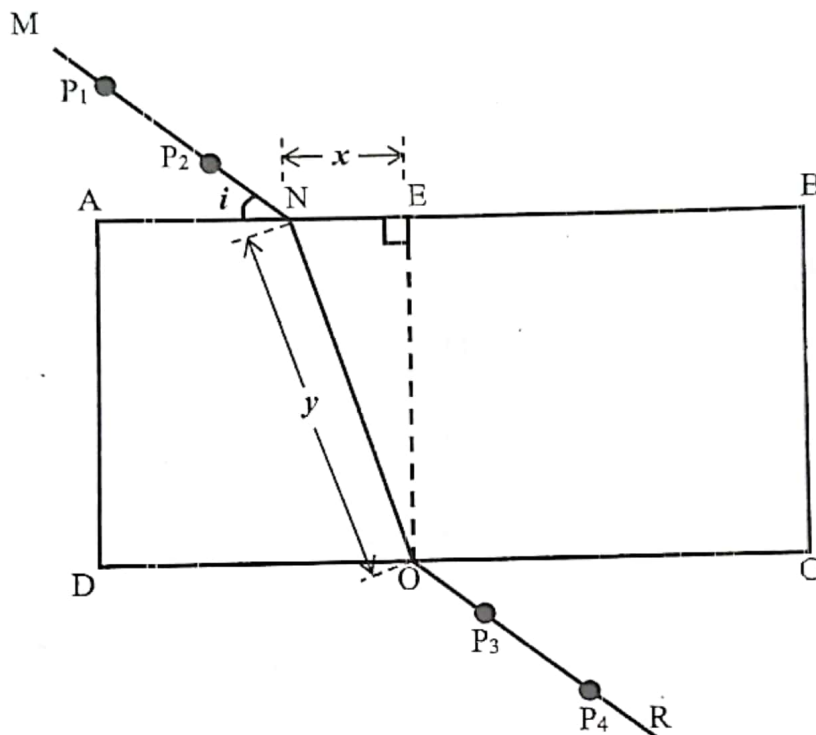


Fig. 2.1

- c) Remove the glass block from its outline.
- d) Draw a line MN making an angle, $i = 30^\circ$ with AB such that AN = 2.0 cm.
- e) Replace the glass block on its outline.
- f) Stick two pins P_1 and P_2 vertically on the line MN.
- g) Looking through the glass block from side DC, stick two pins P_3 and P_4 vertically such that they appear to be in line with the pins P_1 and P_2 as seen through the glass block.
- h) Remove the glass block and the pins.
- i) Draw a line OR through the positions of pins P_3 and P_4 to meet side DC at O.
- j) Join O to N.
- k) At point E, draw a perpendicular line EO.
- l) Measure and record the lengths x and y .

- m) Repeat procedures (d) to (l) for values of $i = 40^\circ, 50^\circ, 60^\circ, 70^\circ$ and 80° .
- n) Tabulate your results including values of $(y-x)$ and $\frac{1}{(y+x)}$.
- o) Plot a graph of $(y-x)$ and $\frac{1}{(y+x)}$.
- p) Find the slope, S of the graph.
- q) Calculate b_1 from the expression:

$$b_1 = S^{\frac{1}{2}}$$

METHOD II

- a) Fix a fresh white sheet of paper on the soft board using drawing pins.
- b) Place the glass block in the middle of the paper with its broadest face uppermost and trace its outline PQRS as shown in figure 2.2.

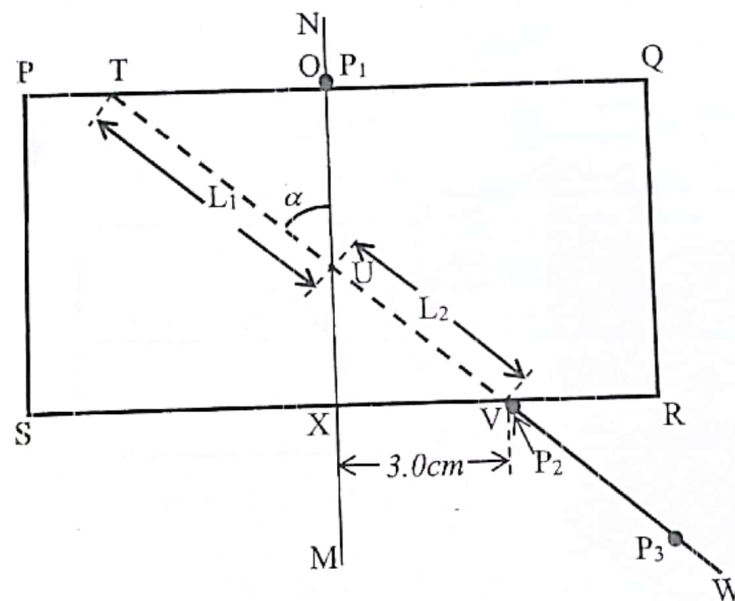


Fig. 2.2

- c) Remove the glass block from its outline.
- d) Draw a normal NM at O, about mid-way side PQ.
- e) Stick pin P_1 vertically and very close to side PQ at O.
- f) Looking through the glass block from side SR, stick pin P_2 vertically and very close to side SR at V.
- g) Stick pin P_3 vertically such that it appears to be in line with the pin P_2 and the image of P_1 as seen through the glass block.
- h) Remove the glass block and the pins.
- i) Draw a line WV through the positions of pins P_2 and P_3 to meet side SR at V.
- j) Produce line WV to cross NM at U and to meet side PQ at T.

- k) Measure and record the lengths L_1 and L_2 , and the angle α .
- l) Calculate b_2 from the expression:

$$b_2 = (L_1 + L_2) \cos \alpha$$
- m) Measure and determine the mean breadth, b_3 of the glass block.
- n) Calculate the constant, θ of the glass block from the expression:

$$\theta = \frac{1}{3}(b_1 + b_2 + b_3)$$

$$L_1 = 3.9 \text{ m}$$

$$L_2 = 4.6 \text{ m}$$

$$\alpha = 38^\circ$$

$$\theta = 46^\circ$$

HAND IN YOUR TRACING PAPERS

3. In this experiment, you will determine the constant, R of the dry cell labelled E .
 (40 marks)

PART I

- a) Connect the circuit shown in figure 3.1.

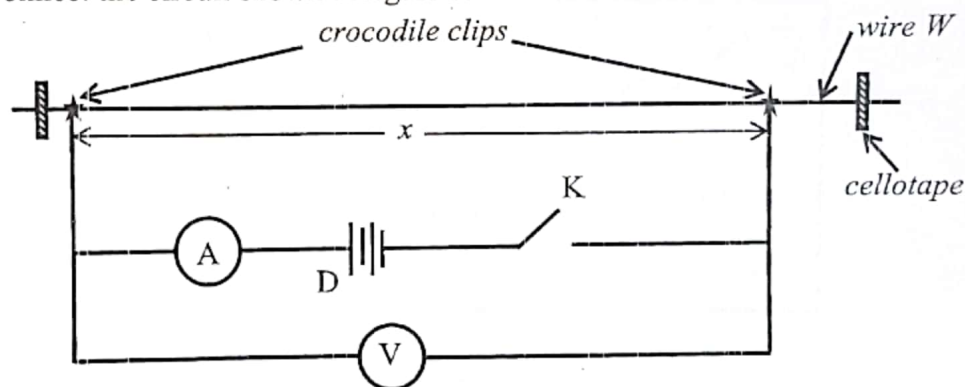


Fig. 3.1

- b) Adjust the length x equal to $x_1 = 0.500 \text{ m}$.
- c) Close switch K .
- d) Read and record the reading of the ammeter I_1 and of the voltmeter V_1 .
- e) Open switch K .
- f) Adjust the length x equal to $x_2 = 0.750 \text{ m}$.
- g) Close switch K .
- h) Read and record the new reading of the ammeter I_2 and of the voltmeter V_2 .
- i) Open switch K .
- j) Calculate r from the expression:

$$r = \frac{I_2 x_2 - I_1 x_1}{V_2 - V_1}$$

PART II

- a) Connect the circuit shown in figure 3.2.

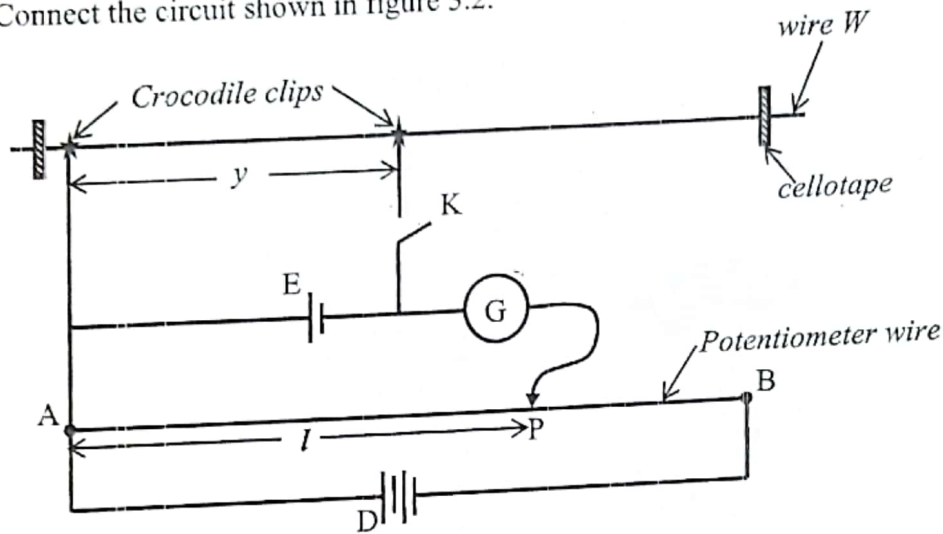


Fig.3.2

- b) With switch K open, move the sliding contact along the potentiometer wire AB and obtain a balance point, P.
- c) Read and record the balance length, l_0 , in metres.
- d) Open switch K.
- e) Adjust the length, y to 0.200 m.
- f) Close switch K.
- g) Move the sliding contact along the potentiometer wire AB and obtain the new balance point, P.
- h) Read and record the balance length, l , in metres.
- i) Open switch K.
- j) Repeat procedures (e) to (i) for values of $y = 0.300, 0.400, 0.500, 0.600$ and 0.700 m.
- k) Tabulate your results including values of $\frac{(l_0 - l)}{l}$ and $\frac{1}{y}$.
- l) Plot a graph of $\frac{(l_0 - l)}{l}$ against $\frac{1}{y}$.
- m) Determine the slope, S of the graph.
- n) Calculate the constant, R of the dry cell from the expression:

$$R = \frac{S}{r}$$

END.