P510/3
PRACTICAL
PHYSICS
Paper 3
July/Aug. 2019
3¼ hrs

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS

PHYSICS PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer question **1** *and* **one** *other question.*

Any additional question(s) answered will **not** *be marked.*

Candidates are **not** *allowed to use the apparatus or write for the first fifteen minutes.*

Graph papers are provided.

Mathematical tables and non – programmable scientific electronic calculators may be used.

Candidates are expected to record all their observations as they are made and to plan the presentation of the records so that it is **not** *necessary to make a fair copy of them. The working of the answers is to be handed in.*

Details on the question paper should **not** *be repeated in the answer, nor is the theory of the experiment required unless specifically asked for.However, candidates should record any special precautions they have taken and any particular features of their methods of going about the experiment.*

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

Turn Over

1. In this experiment, you will determine the force constant $\boldsymbol{K}$, acceleration of free fall, g and the effective mass, M_o of the spring provided.

Procedure:

Part 1

(a) Clamp the spring using the two pieces of wood and attach a pointer to the free end of the spring making sure that the spring is vertical and the pointer is horizontal as shown in the figure below;

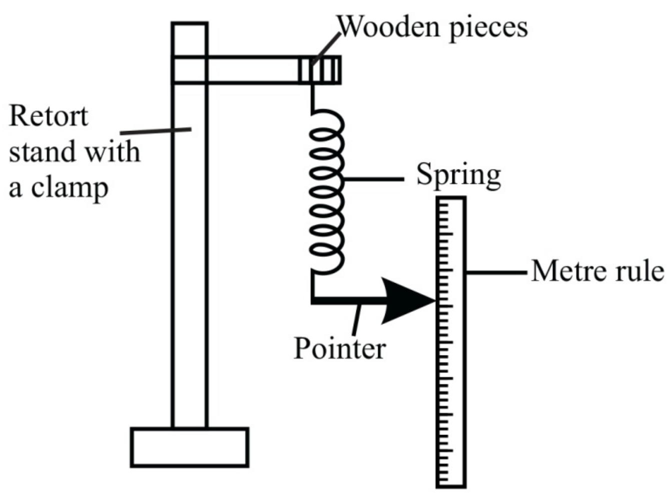

Fig. 1

(b) Read and record the initial position, $\boldsymbol{P_o}$ (in meters) on the vertical meter rule.

(c) Suspend a mass $M = 0.200kg$ from the lower end of the spring. Read and record the new pointer position, $\boldsymbol{P_1}$ (in meters).

(d) Obtain the value of the extension, $\boldsymbol{e}$, of the spring.

(e) Replace the $0.200kg$ mass with $0.600kg$ and record the new pointer position, $\boldsymbol{P_2}$ (in meters).

(f) Obtain the new extension, $\boldsymbol{e_2}$ of the spring.

(g) Calculate the constant, $\boldsymbol{K}$, of the spring from the expression $K = \frac{0.4g}{e_2 - e_1}$ where $g = 9.81ms^{-2}$.

(h) Find the constant, δ, from the expression $\delta = 2.5\,(e_2 - e_1)$.

Part II

(a) Suspend a mass, $m, = 0.100kg$ from the spring, in part 1.

(b) Pull the mass vertically downwards through a small displacement and release it.

(c) Measure the time, $\boldsymbol{t}$ for 20 oscillations of the mass. Hence obtain the period of oscillations, $\boldsymbol{T}$.

(d) Repeat the procedure (a) to (c) for values of $m = 0.200, 0.300, 0.400, 0.500$ and $0.600kg$.

(e) Tabulate your results including values of $\boldsymbol{T^2}$.

(f) Plot a graph of $\boldsymbol{T^2}$ against m.

(g) Determine the slopes, $\boldsymbol{S}$, of the graph.

(h) Calculate the value of $\boldsymbol{g}$ from the expression $= \frac{4\pi^2\delta}{S}$.

(i) Read and record the intercept, $\boldsymbol{M}$, on the $\boldsymbol{T^2}$ – axis.

(j) Calculate the effective mass, $\boldsymbol{Mo}$, of the spring from $\boldsymbol{Mo} = \frac{C}{S}$.

2. In this experiment you will determine the refractive index, $\boldsymbol{n}$ of a glass prism. (33 marks)

Part 1

(a) Fix a plain sheet of paper on a soft board using pins.

(b) Place the glass prism on the paper and trace its outline.

(c) Remove the prism and label its outline $\boldsymbol{PQR}$ as shown in the figure 2 below.

(d) Mark point, $\boldsymbol{V}$ midway between $\boldsymbol{P}$ and $\boldsymbol{Q}$ along $\boldsymbol{PQ}$.

Turn Over

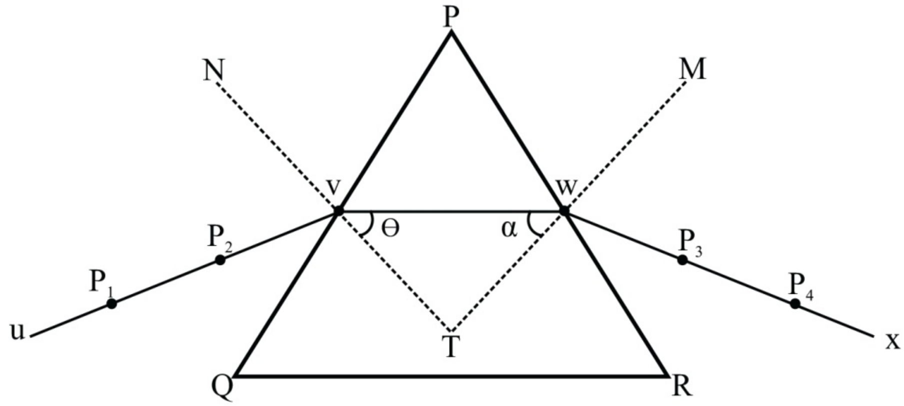

Fig. 2

(e) Draw a normal to side $\boldsymbol{PQ}$ through point $\boldsymbol{V}$.

(f) Draw line $\boldsymbol{UV}$ making an angle of $30\ ^{o}$ with the normal.

(g) Fix pins $\boldsymbol{P_1}$ and $\boldsymbol{P_2}$ vertically upright on line $\boldsymbol{UV}$.

(h) Replace the prism on its outline.

(i) While viewing through face ***PR***, fix pins $\boldsymbol{P_3}$ and $\boldsymbol{P_4}$ such that they appear to be in line with pins $\boldsymbol{P_1}$ and $\boldsymbol{P_2}$.

(j) Remove the prism.

(k) Draw a line ***XW*** through the marks of $\boldsymbol{P_3}$ and $\boldsymbol{P_4}$.

(l) Join ***V*** to ***W***.

(m) Draw a normal ***MW*** at ***W*** and extending it until it meets the normal ***NV***.

(n) Measure and record angles θ and∝.

(o) Calculate the constant ***A*** from $A\ =\ (\theta + \propto)$.

Part II

(a) Fix the second sheet of paper provided on the soft board using drawing pins.

(b) Place the glass prism on the sheet of paper and trace its outline ***ABC*** as shown in fig 3 below.

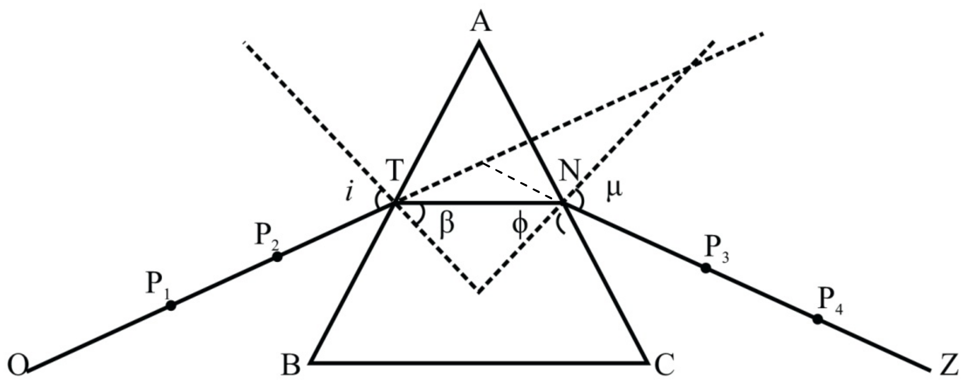

Fig. 3

(c) Remove the prism and draw a normal to ***AB*** at a point ***T***, a distance of about $1.5cm$ from point ***A***.

(d) Draw line ***OT*** making an angle $l = 30^o$ with the normal.

(e) Place the optical pins $\boldsymbol{P_1}$ and $\boldsymbol{P_2}$ vertically on the line ***OP*** such that the angle ***i*** is equal to 30^o.

(f) Replace the prism on its outline.

(g) While observing pins, $\boldsymbol{P_1}$ and $\boldsymbol{P_2}$ through face ***AC***, fix pins $\boldsymbol{P_3}$ and $\boldsymbol{P_4}$such that they appear to be in line with pins $\boldsymbol{P_1}$ and $\boldsymbol{P_2}$.

(h) Remove the prism and pins and join ***Z*** to ***N*** through $\boldsymbol{P_4}$ and $\boldsymbol{P_3}$ and join also ***N*** to ***T***.

(i) Measure and record the angles; μ, β and ϕ.

(j) Repeat procedure (d) to (g) for $i = 35^o, 40^o, 45^o, 50^o, 55^o, 60^o, 70^o$ and 75^o.

(k) Tabulate you results including values of; $a = (i - \beta)$, $b = (\mu - \phi)$ and $D = (a + b)$.

(l) Plot a graph of D against i.

Turn Over

(m) Determine from your graph, the value Dm for which D has the lowest value.

(n) Calculate the refractive index, $\boldsymbol{n}$, of glass from the expression;

$$Sin\ \frac{A}{2} = \frac{1}{n}\left(Sin\ \frac{Dm+A}{2}\right).$$

HAND IN THE PLAIN SHEETS OF PAPER WITH THE TRACINGS TOGETHER WITH THE REST OF THE WORK.

3. In this experiment, you will determine;

(i) the pd percm,K_o the slide wire potentiometer.

(ii) the calibration of a voltmeter using a slide wire potentiometer.

(33 marks)

PART 1

(a) Connect the voltmeter provided across the terminals of the cell labelled $\boldsymbol{C}$.

(b) Read and record the reading E_o of the voltmeter.

(c) Connect the circuit shown in figure 4 below.

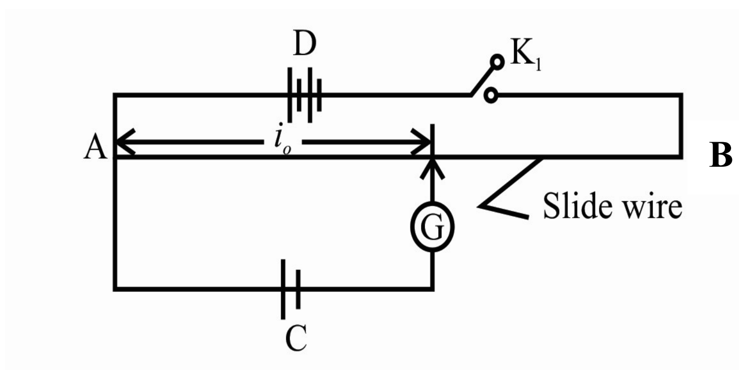

Fig. 4

(d) Close switch $\boldsymbol{K_1}$.

(e) Move the sliding contact along the slide wire to locate a point on ***AB*** for which the galvanometer ***G*** shows no deflection.

(f) Measure and record the balance length l_o.

(g) Open switch $\boldsymbol{K_1}$.

(h) Calculate the value of $\boldsymbol{K_o}$ from the expression $K_o = \frac{E_o}{l_o}$.

PART II

(a) Connect the circuit shown in figure 5 below.

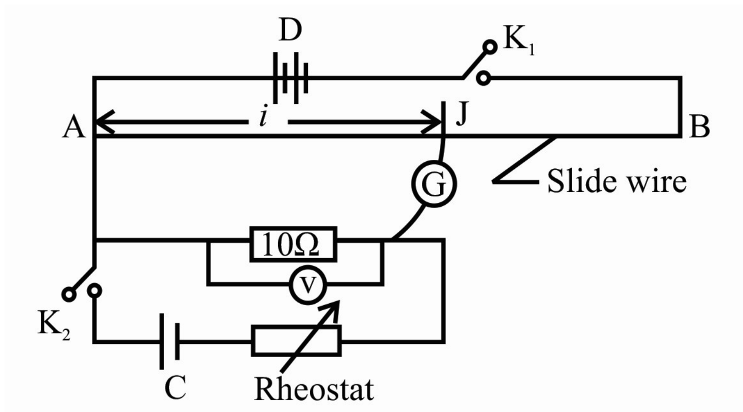

Fig. 5

(b) Close switches $\boldsymbol{K_1}$ and $\boldsymbol{K_2}$.

(c) Adjust the rheostat until the voltmeter reading $V_o = 0.35V$.

(d) Move the sliding contact along ***AB*** to locate the balance point when ***G*** shows no deflection.

(e) Read and record the balance length $\boldsymbol{l}$.

(f) Open switches $\boldsymbol{K_1}$ and $\boldsymbol{K_2}$.

(g) Repeat procedures (b) to (f) for voltmeter readings, $\boldsymbol{V_o} = -0.40, 0.45,$ $0.50, 0.55, 0.60$ and $0.65V$.

(h) Tabulate your results, including values of $Vm = E_o\left(\frac{l}{l_o}\right)$.

(i) Plot a graph of Vm against V_o.

(j) Determine the slope $\boldsymbol{S_2}$ of the graph.

(k) Comment on the value of the slope.

END