P510/3
PRACTICAL
PHYSICS
Paper 3

June/July, 2019

3¼ hours

MOCK EXAMINATIONS 2019

Uganda Advanced Certificate of Education

PHYSICS

PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer ***question*** **1** *and* ***ONE other*** *question.*
Candidates will not be allowed to use the apparatus or write for the first fifteen minutes.
Graph papers are provided.
Non – programmable silent electronic calculators may be used.
Candidates are expected to record on their scripts 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.
Candidates should however record any special precautions that they have taken and any particular features of their method of going about the experiment.

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.

Question 1

In this experiment, you will determine the force constant, k, of the spring provided. ***(40 marks)***

PART I

(a) Clamp the spring provided between two small pieces of wood and attach a mass M_1 = 0.200 kg at its free end as shown in figure 1

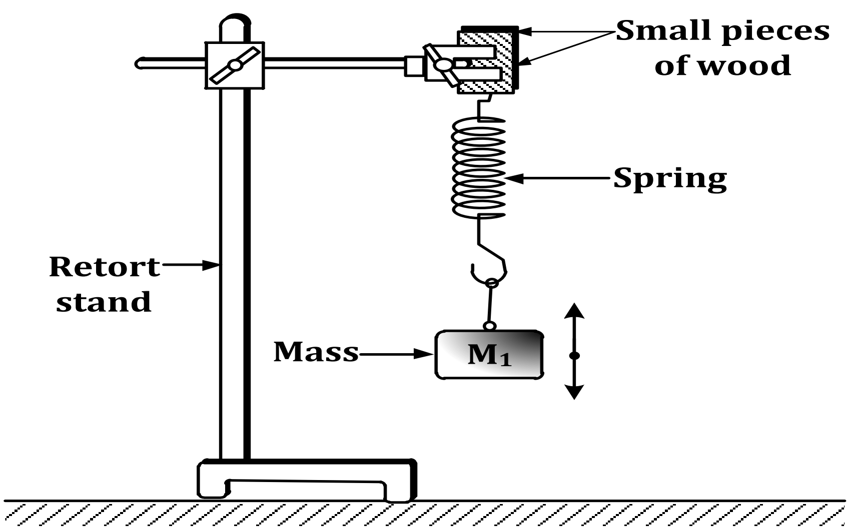

Fig.1

(b) Displace the mass down vertically through a small distance and set it into vertical oscillations.

(c) Start the stop clock, and record the time, $\mathbf{t_1}$, for twenty complete oscillations.

(d) Determine the period $\mathbf{T_1}$, of the oscillations.

(e) Calculate the value of T_1^2.

(f) Determine k_0 from $\mathbf{k_0} = \left(\frac{4\pi^2 M_1}{{T_1}^2}\right)$ Take, $\pi = 3.14$ and, where necessary, assume $(1 \text{ kg s}^{-2} = 1\text{Nm}^{-1})$

(g) Repeat the procedures (a) to (f) above using a mass M_2 = 0.300 kg.

(h) Determine the corresponding time $\mathbf{t_2}$ for 20 complete oscillations and the periodic time $\mathbf{T_2}$., hence determine the value of $\mathbf{T_2^2}$.

(i) Calculate $\mathbf{k_0}'$ from $\mathbf{k_0}' = \left(\frac{4\pi^2 M_2}{T_2{}^2}\right)$ Take, $\pi = 3.14$ and where necessary, assume, $(1\ \text{kg s}^{-2} = 1\text{Nm}^{-1})$

(j) Determine the force constant of the spring, k_1, from the expression;

$$\mathbf{k_1 = 0.50\ (k_0 + k_0{}')}$$

PART II

(a) Measure and record the mass M_0, of the half metre rule provided in kg.

(b) Tie a loop at the centre of metre rule **A** using the longest piece of thread provided and tie the other end of the thread onto the horizontal metal rod of the clamp placed at the top of a retort stand.

(c) Balance the metre rule **A** horizontally with its graduated face towards you. Read and record the centre of gravity **G** of metre rule **A.**

(d) Tie the shortest piece of thread at the 54.0 cm mark from the left hand side of metre rule **A**, call it $\mathbf{X_1}$ and tie its free end to the spring provided.

(e) Measure and record distance, d_1, of $\mathbf{X_1}$ from G in metres.

(f) Clamp a second metre rule **B** vertically at the end of the clamp, so that it is closer to the spring, with its graduated face towards you.

(g) Read and record, the initial position $\mathbf{P_1}$, in metres of the lowest part of the spring with help of a straight edge.

(h) Tie the remaining piece of thread at the centre of the half metre rule provided then, put a loop at the other end of the string.

(i) Attach a mass hanger, M = 0.100 kg at the lower end of the Spring, then suspend a half metre rule at the opposite end of the metre rule **A** using the remaining piece of thread as shown in figure 2.

(j) Adjust the position of the loop of the thread on metre rule A until the metre rule **A** balances horizontally at this position. Mark and record the position of the thread supporting the half metre rule as $\mathbf{X_2}$.

(k) Measure and record, the distance, d_2 , of $\mathbf{X_2}$ from **G** , in metres.

(l) Read and record , the new position P_2 of the lowest part of the spring on metre rule **B** .

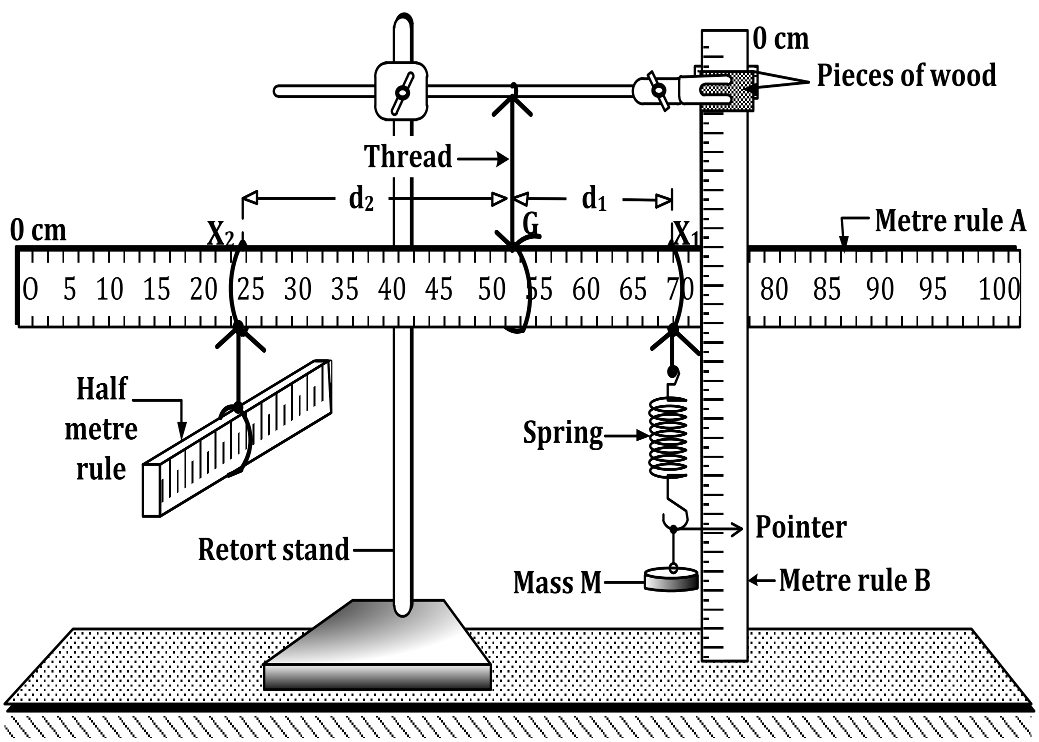

Fig .2

(m) Determine the extension, $y = (P_2 - P_1)$ of spring.

(n) Repeat procedures (i) to (m) for values of, M = 0.200, 0.300, 0.400, 0.500 and 0.600kg.

(o) Tabulate the results in a suitable table including values of d_2 and y.

(p) Plot a graph of d_2 against y.

(q) Determine the slope, **S**, of the graph.

(r) Calculate the constant, $\mathbf{k_2}$, of the spring from the expression,

$$\mathbf{k_2} = \mathbf{S}\left(\frac{M_0\,g}{d_1}\right) \qquad \text{where } g = 9.81 \text{ N kg}^{-1}$$

(s) Determine the value of the force constant **k,** of the spring, from the expression; $\mathbf{k} = \frac{(\mathbf{k_1} + \mathbf{k_2})}{\mathbf{2}}$

Question 2

In this experiment, you will determine the focal length of a convex lens using two methods. ***(40 marks)***

METHOD I

(a) Arrange the mounted pin, converging lens and the plane mirror as shown in figure 3

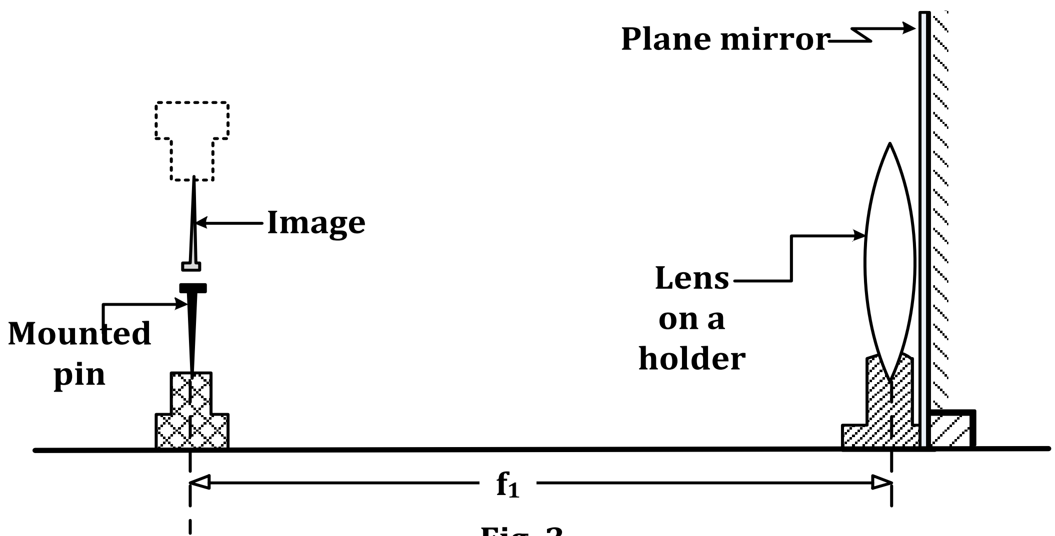

Fig. 3

(b) Adjust the position of the pin until its image appears to coincide with it.

(c) Measure and record the distance, f_1, between the lens and the pin.

METHOD II

(a) Connect the torch bulb in series with the dry cells and switch, K.

(b) Set up the arrangement shown in figure 4

(c) Adjust the position of the lens such that the distance u = 40.0 cm.

(d) Adjust the position of the screen until a clear image of the wire gauze is obtained on it.

(e) Measure and record the distance, y, between the two screens.

(f) Without changing the position of the screens, displace the lens so that another clear but magnified image of the wire gauze is formed on the screen.

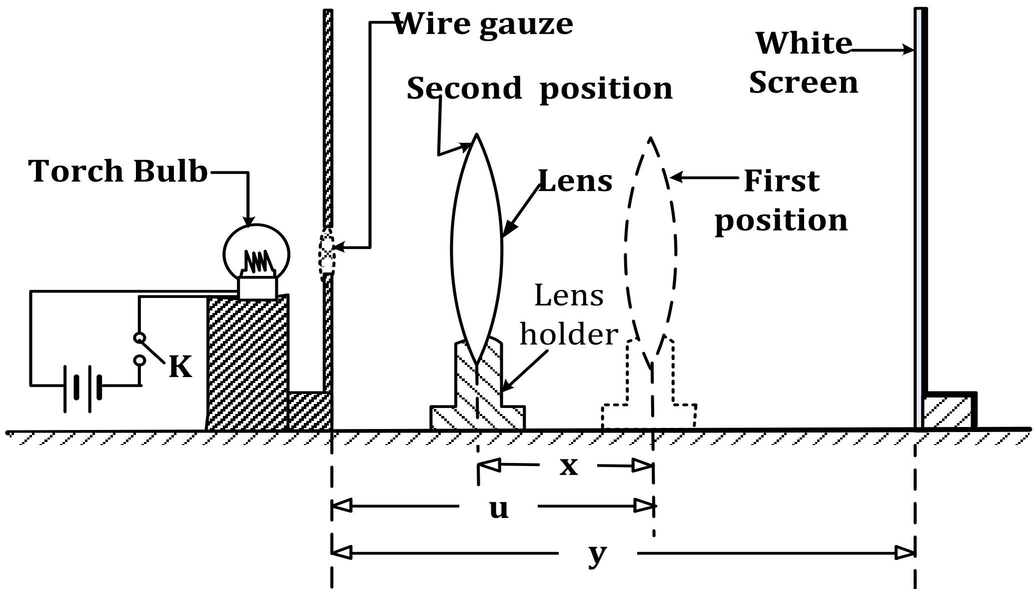

Fig. 4

(g) Measure and record the distance, x, between the two positions of the lens.

(h) Repeat procedures (c) to (g) for values of u = 50.0, 60.0, 65.0, 70.0 and 80.0cm.

(i) Tabulate your results including values of x^2 and $\frac{x^2}{y}$

(j) Plot a graph of $\frac{x^2}{y}$ against y.

(k) Read and record the intercepts, C_1, on the vertical axis and C_2 on the horizontal axis.

(l) Calculate f_2 from the expression;

$$f_2 = \frac{1}{8}(C_2 - C_1)$$

Question 3

In this experiment, you will determine the;

(i) resistance per metre, k, of the wire labelled W,

(ii) internal resistance, r, of the dry cell labelled C_1. ***(40 marks)***

PART I

(a) Connect the circuit shown in figure 5 with distance x = 1.00 cm.

(b) Close switch $\mathbf{K_1}$ and adjust the rheostat so that the ammeter indicates a current $\mathbf{I_1}$ = 0.06 A.

(c) Read and record the voltmeter reading $\mathbf{V_1}$.

(d) Calculate k_1 from the expression, $k_1 = \frac{V_1}{I_1 x}$

(e) Repeat procedure (b) for $\mathbf{I_2}$ = 0.08 A, read and record the voltmeter reading $\mathbf{V_2}$.

(f) Calculate k_2 from the expression, $k_2 = \frac{V_2}{I_2\, x}$

(g) Calculate k from the expression, $\mathbf{k} = \frac{k_1 + k_2}{2}$.

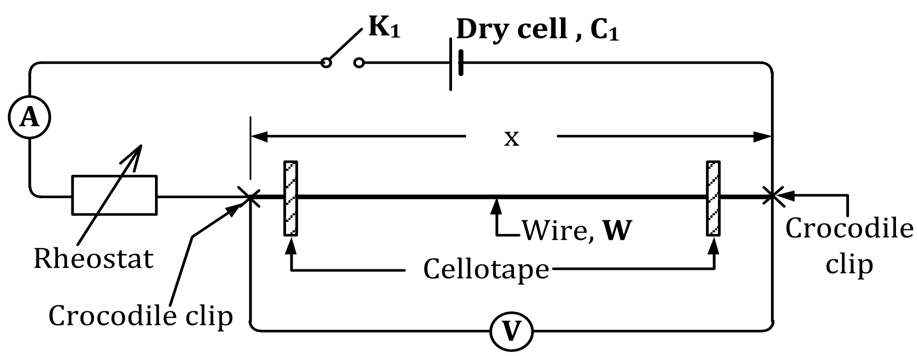

Fig. 5

PART II

(a) Connect the circuit shown in figure 6

(b) With switch K_2 open and switch K_1 closed, use the sliding contact to find the balance length L_0.

(c) Open switch K_1.

(d) Adjust the distance, **y**, to 0.300 m.

(e) Close switches K_1 and K_2.

(f) Determine the balance length L.

(g) Open switches K_1 and K_2.

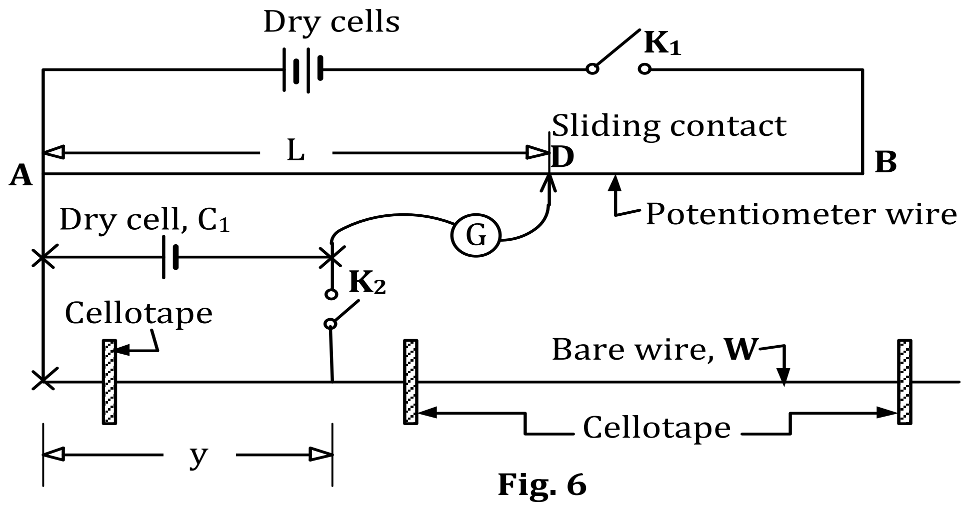

Fig. 6

(h) Repeat procedures (d) to (g) for y = 0.400 m, 0.500 m, 0.600 m, 0.700 m and 0.800 m.

(i) Record your results in a suitable table, including values of $\frac{1}{L}$ and $\frac{1}{y}$

(j) Plot a graph of $\frac{1}{L}$ against $\frac{1}{y}$

(k) Calculate the slope, **S**, on the graph.

(l) Calculate the internal resistance, r, of dry cell C_1 from the expression $\mathbf{S} = \frac{r}{\mathbf{K}\, L_0}$

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