P510/3
PRACTICAL
PHYSICS
Paper 3
August, 2023
3¼ hours

JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS – AUGUST, 2023

PHYSICS PRACTICAL

(PRINCIPAL SUBJECT)

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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

Candidates are not allowed to use the apparatus or write for the first fifteen minutes.
Graph papers are provided.
Mathematical tables and non – programmable silent electronic calculators may be used.
Write on one side of the paper only.
Candidates are expected to record on their scripts all their observations as these observations 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.

1. **In this experiment, you will determine the mass, m_b of the rubber bung provided using two methods.**

METHOD I

(a) Record the mass, M in kilograms, of the metre rule provided.

(b) Balance the metre rule on a knife edge and locate the balance point, G.

(c) Suspend the rubber bung at the 5.0 cm mark of the metre rule and balance the metre rule horizontally as shown in the figure 1.1.

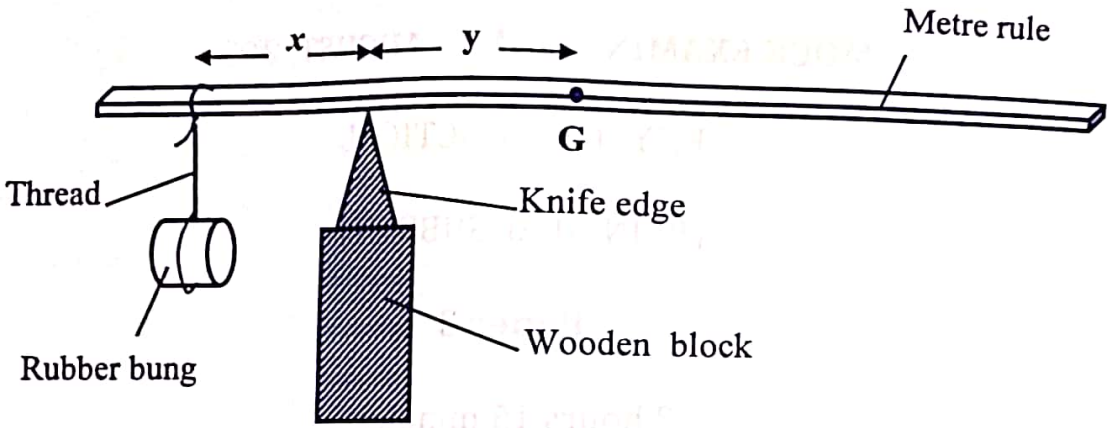


Fig. 1.1

(d) Record the distances x and y.

(e) Calculate the value of m_1 from the expression;

$$m_1 = M\frac{y}{x}$$

METHOD II

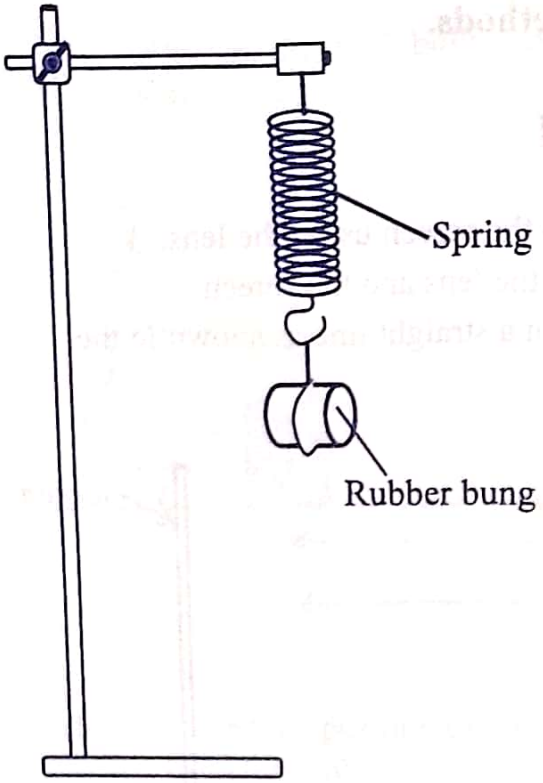


Fig. 1.2

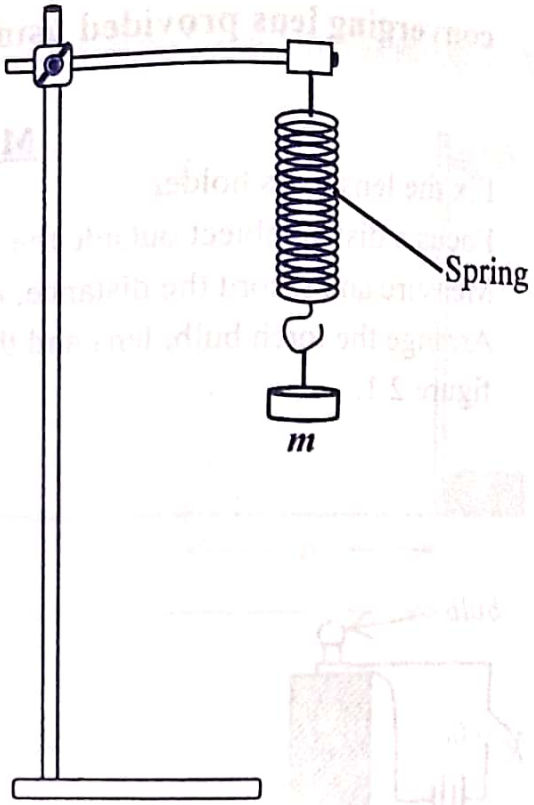


Fig. 1.3

(a) Clamp the spring provided vertically from the retort stand.
(b) Suspend the rubber bung from the spring as shown in the figure 1.2.
(c) Pull the spring slightly downwards and release it to perform vertical oscillations.
(d) Measure and record the time, t_1 for twenty oscillations.
(e) Determine the period, T_1 of the oscillations.
(f) Remove the rubber bung from the spring.
(g) Suspend a mass $m = 0.200$ kg from the spring as shown in the figure 1.3.
(h) Pull the mass slightly downwards and release it to perform vertical oscillations.
(i) Measure and record the time, t_2 for twenty oscillations.
(j) Determine the period, T_2 of the oscillations.
(k) Repeat procedure (g) to (j) for values of $m = 0.250$, 0.300, 0.400, 0.500 and 0.600 kg.
(l) Tabulate your results including values of $\left(\frac{T_2}{T_1}\right)^2$.
(m) Plot a graph of $\left(\frac{T_2}{T_1}\right)^2$ against m.
(n) Determine the slope, S of the graph.
(o) Calculate the value of m_2 from the expression;

$$m_2 = \frac{1}{S}$$

(p) Find the mass m_b of the rubber bung from the expression;

$$m_b = \frac{m_1 + m_2}{2}$$

(q) State **one** particular precaution you took to ensure accuracy of your result.

2. In this experiment, you will determine the constant, R of the converging lens provided using two methods.

METHOD I

(a) Fix the lens in its holder.
(b) Focus a distant object outside the room onto the screen using the lens.
(c) Measure and record the distance, d between the lens and the screen.
(d) Arrange the torch bulb, lens and the screen in a straight line as shown in the figure 2.1.

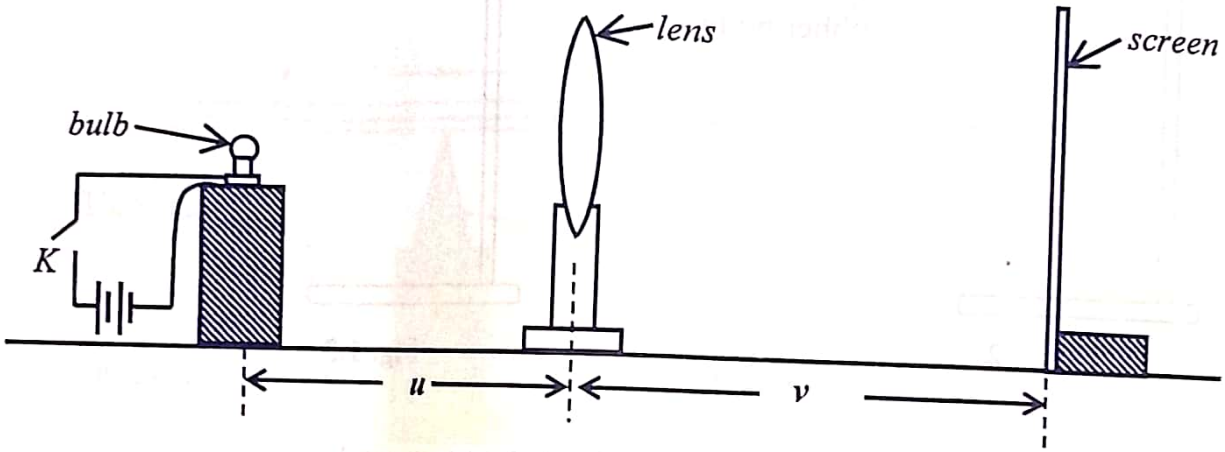


Fig. 2.1

(e) Adjust the position of the lens such that its distance from the bulb is $u = (d+x)$ *cm*, where $x = 10.0$ cm.
(f) Close the switch *K*.
(g) Starting with the screen close to the lens, adjust the position of the screen to obtain a clear sharp image of the filament light on it.
(h) Measure and record the distance, v between the lens and the screen.
(i) Repeat procedure (e) to (h) for values of $x = 15.0$, 20.0, 25.0, 30.0 and 35.0 *cm*.
(j) Tabulate your results including values of $\frac{1}{x}$ and $\mathbf{y = (v - d)}$.
(k) Plot a graph of y against $\frac{1}{x}$.
(l) Find the slope, S of the graph.
(m) Calculate the value of R_1 from the expression;

$$R_1 = 2\sqrt{S}$$

METHOD II

(a) Arrange the torch bulb, lens and the screen in a straight line as shown in the figure 2.2.

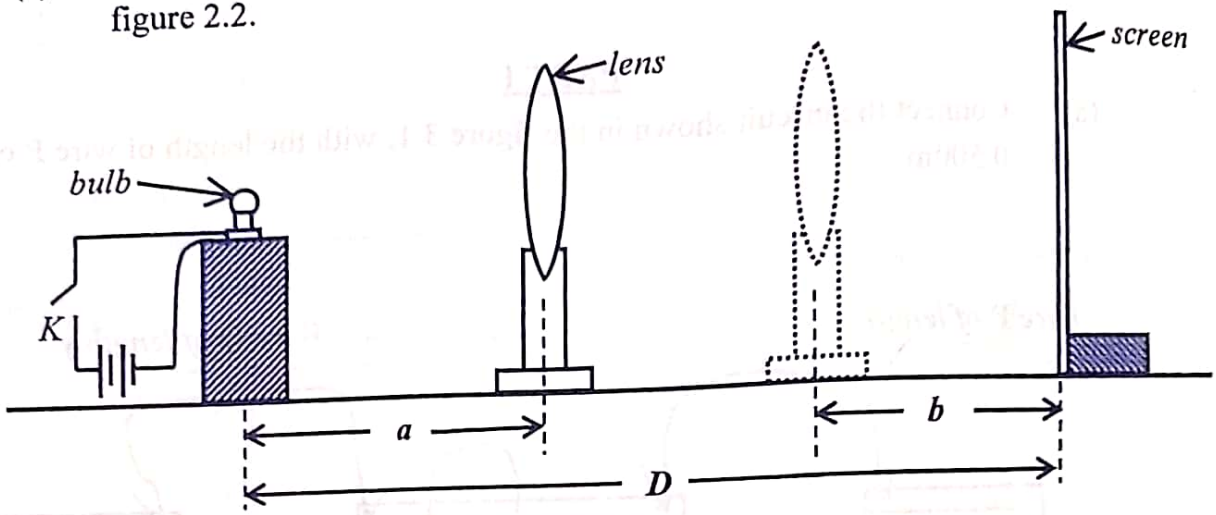


Fig. 2.2

(b) Adjust the position of the screen such that it is at a distance of D = 60.0 *cm* from the bulb.

(c) Close switch K.

(d) Starting with the lens close to the bulb, move the lens towards the screen until a clear magnified image of the filament light is formed on the screen.

(e) Measure and record distance, a between the bulb and the lens.

(*f*) Keeping the distance D fixed, move the lens further towards the screen to obtain a clear diminished image of the filament light on the screen.

(g) Measure and record distance, b between the lens and the screen.

(h) Calculate the value of $\beta = a + b$.

(*i*) Calculate the value of R_2 from the expression;

$$R_2 = \beta - \left(\frac{\beta^2}{2D}\right)$$

(*j*) Find the value of the constant, R from the expression;

$$2R = R_1 + R_2$$

(k) State **one** source of error that must have affected the accuracy of your value of R.

3. **In this experiment you will determine the constant, k of the bare wire labelled Q provided.**

PART I

(a) Connect the circuit shown in the figure 3.1, with the length of wire P of x = 0.500m.

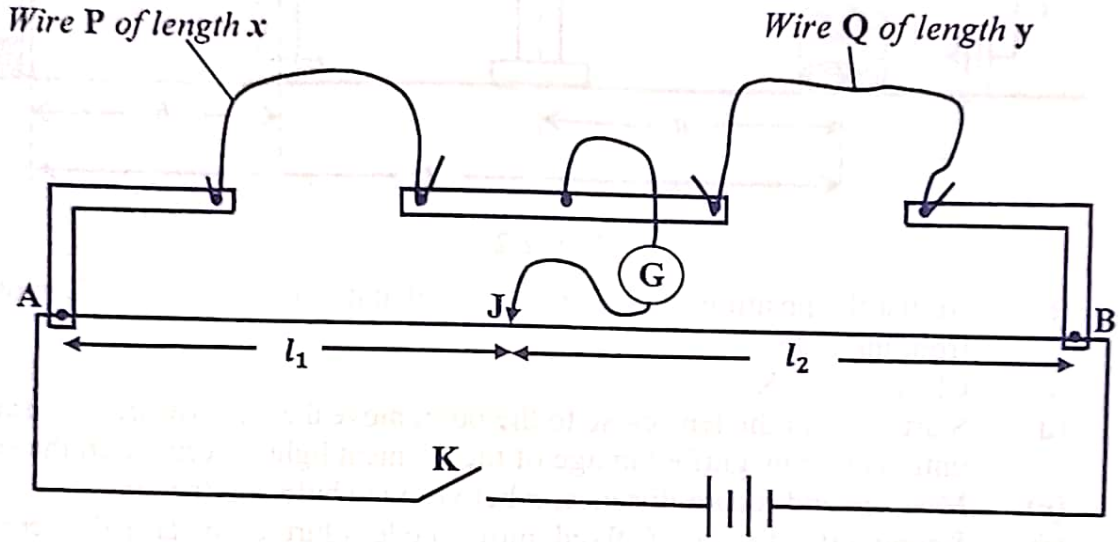


Fig.3.1

(b) Adjust the length of wire Q to y = 0.200m.

(c) Close switch K and locate the balance point, J along the metre bridge wire AB.

(d) Measure and record the balance lengths l_1 and l_2, in metres.

(e) Open switch K.

(f) Repeat procedure (b) to (e) for values of y = 0.300, 0.400, 0.500, 0.600 and 0.700m

(g) Tabulate your results including values of $\frac{x}{y}$ and $\frac{l_1}{l_2}$.

(h) Plot a graph of $\frac{x}{y}$ against $\frac{l_1}{l_2}$.

(i) Find the slope, S of the graph.

PART II

(a) Fix the wire **Q** used in Part I on the table surface using Sellotape.
(b) Connect the circuit shown in the figure 3.2 with the length, **y** of the wire Q of

$y_1 = 0.400$ m.

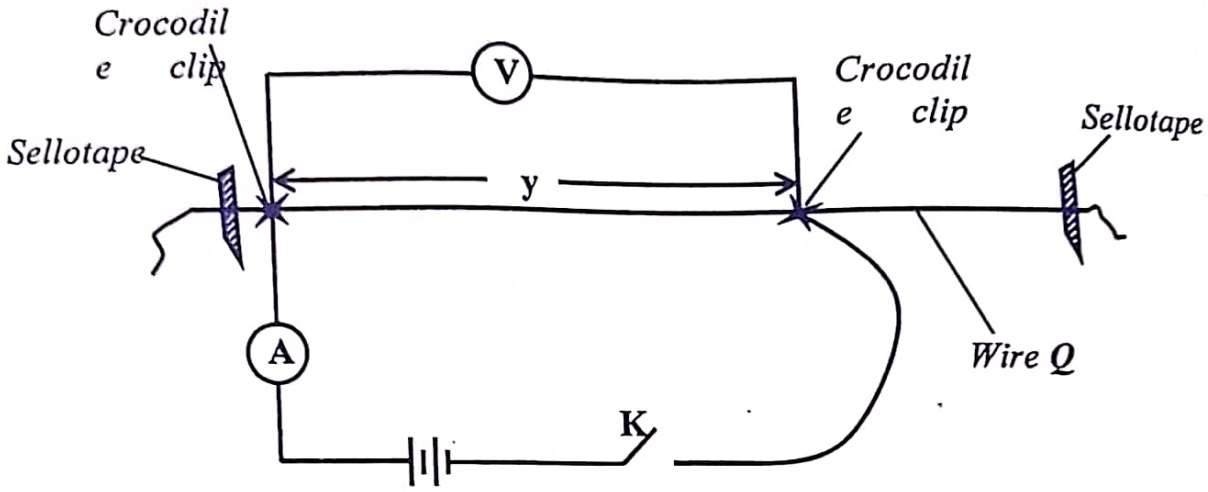


Fig.

(c) Close switch **K**.
(d) Read and record the ammeter reading, I_1 and the voltmeter reading, V_1.
(e) Open switch **K**.
(f) Adjust the length **y** to $y_2 = 0.600$ m.
(g) Close switch **K**.
(h) Read and record the ammeter reading, I_2 and the voltmeter reading, V_2.
(i) Calculate the value of θ from the expression;

$$\theta = \frac{V_2 - V_1}{I_2 y_2 - I_1 y_1}$$

(j) Obtain the value of k from the expression;

$$k = \frac{\theta}{S}$$

where S is the slope of the graph in Part I above.

(k) Give any **one** precaution that you took to minimize errors in the experiment.

 End

JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS – 2023

P510/3 - PHYSICS PRACTICAL

(PRINCIPAL SUBJECT) Paper 3

SAMPLE RESULTS AND MARKING GUIDE

Lanrence : 2 and

Lines : 1

SAMPLE RESULTS

QUESTION 1

METHOD I

a) M = 0.1181kg

d) x = 21.8cm

y = 23.0cm

e) $m_1 = \frac{0.1181 \times 0.230}{0.218}$

$= 0.125\text{kg}$

METHOD II

d) t_1 = 8.5s

e) T_1 = 0.43s

f)

m(kg)	t_2(s)	T_2(s)	$\frac{T_2}{T_1}$	$\left(\frac{T_2}{T_1}\right)^2$
0.200	11.5	0.575	1.3	1.7
0.250	12.5	0.625	1.5	2.3
0.300	14.0	0.700	1.6	2.6
0.400	15.5	0.775	1.8	3.2
0.500	17.5	0.875	2.0	4.0
0.600	19.0	0.950	2.2	4.8

T = 20

n) $S = \frac{5.45-1.50}{0.69-0.17}$

$= 7.6\text{kg}^{-1}$

o) $m_2 = \frac{1}{S}$

$m_2 = \frac{1}{7.6}$

$= 0.13\text{kg}$

p) $m_b = \frac{0.125+0.13}{2}$

$= 0.13\text{kg}$

q)

Precaution: - Slight displacements to set the system in oscillation
- Shielding the system incase of wind

Scoring Codes

A_1=1+½ – M + unit

A_2= 1 x + unit

A_3= 1 y + unit

A_4= ½ M_1 Substitu

A_5= ½+½ M_1 + Uni

05

TABLE.

B_1= 1+½ – t_1 + un

B_2= 1+½ T_1 + unit

B_3= 2½ – Quantity

B_4= 2½ – Unit

B_5= 6 values of t_2

B_6= 3 Value of T_2

B_7= 3 value of $\frac{T_2}{T_1}$

B_8= 3 value of $\left(\frac{T_2}{T_1}\right)^2$

23

GRAPH

C_1=½ Title

C_2= ½+½ axes

C_3= ½+½ scale

C_4= 3 Plotting

C_5= ½ line of best fit

C_6= ½ Triangle

C_7= ½ Substitution sh

C_8= 1+½ correct value

C_9= ½+½+½ value of

C_{10}= ½+½ value of N

C_{11}= 1 Precaution

12

40 MARKS

QUESTION 2

METHOD I

d = 10.0 cm

x(cm)	u(cm)	v(cm)	$\frac{1}{x}$(cm^{-1})	y(cm)
10.0	20.0	19.6	0.1000	9.6
15.0	25.0	16.5	0.0667	6.5
20.0	30.0	15.0	0.0500	5.0
25.0	35.0	14.0	0.0400	4.0
30.0	40.0	13.5	0.0333	3.5
35.0	45.0	13.0	0.0285	3.0

l) $S = \frac{9.8-2.8}{\frac{0.102-0.026}{7.0}}$

$= \frac{0.076}{}$

$= 92\ cm^2$

n) $R_1 = 2\sqrt{92}$

$= 19\ cm$

METHOD II

e) a = 12.0cm

g) b = 13.2cm

h) β = 25.2cm

i) $R_2 = 25.2 - (\frac{25.2^2}{2\times60.0})$

j) $= 19.9cm$

$R = \frac{19+19.9}{2}$

k) **METHOD I** $= 19.5cm$ I

Source of error: - Uncertainty of the exact clear image
- Error in measuring exact distances

Scoring Codes

A_0=1+½ d + units.

~~A_1=1+½~~

~~A_2=1+½~~

A_3= 2½ qty

A_4= 2½ Units

A_5= 6 — u

A_6= 3 A_7= 3 — $\frac{1}{x}$

A_8 = 3 — y

21½

B_1=½ — Title

B_2= ½+½ - axes

B_3= ½+½ — Scale

B_4= 3 — plotting

B_5= ½ — line of best fit

B_6= ½ — triangle for

B_7= ½ — Slope Subst

B_8= 1+½ — correct val + unit

B_9=½ — R - Substitut

B_{10}= 1+½ — correct R unit

10½

C_1=1+½ — a + u

C_2= 1+½ — b + u

C_3= ½+ ½ — β + u

C_4= ½ — R_2 Substit

C_5= 1+½ - R_2 + Uni

C_6=½+ ½ - R + unit

C_7= 1 - Error.

08

40 MARKS

QUESTION 3

PART I

a) $x = 0.500$ m

d) $l_1 = 0.753$m
$l_2 = 0.247$m

g)

y(m)	l_1(m)	l_2(m)	$\frac{x}{y}$	$\frac{l_1}{l_2}$
0.200	0.753	0.247	2.50	3.05
0.300	0.670	0.330	1.67	2.03
0.400	0.645	0.355	1.25	1.82
0.500	0.605	0.395	1.00	1.53
0.600	0.563	0.437	0.83	1.29
0.700	0.525	0.475	0.71	1.11

i) $S = \frac{2.44-0.50}{2.90-1.00}$
$= \frac{1.94}{1.90}$
$= 1.02$

PART II

b) $y_1 = 0.4000$m

d) $I_1 = 0.56$A

f) $V_1 = 1.30$V

h) $y_2 = 0.6000$m

i) $I_2 = 0.42$A
$V_2 = 1.55$V

j) $\theta = \frac{1.55-1.30}{(0.42\times0.600)-(0.56\times0.400)}$

k) $= 8.9\ \Omega m^{-1}$ or $VA^{-1}m^{-1}$

Scoring Codes

A1=1 – $L_1 + L_2$
A2= 2½ – Qty
A3= 2½ – unit.
A4= 6 – L_1
A5= 3 – L_2
A6= 3 – x
A7= 3 – y
21 – L_1, L_2

B1= ½ – Title
B2= ½+½ axes
B3= ½+½ scale
B4= 3 plotting
B5= ½ line of B.F.
B6= ½ triangle for slope
B7= ½ B8= ½ correct value
slope subst
08½

C1=1+½ I_1 and unit.
C2= 1+½ V_1 and Unit
C3= 1+½ I_2 and Unit
C4= 1+½ V_2 and Unit
C5= ½ – S substitution
C6= ½+½ S and Unit
C7= ½ K substitution
C8= 1+½ K + unit.
C9= 1 – precaution.
10½

40 MARKS

5

$k = \frac{8.9}{1.02}$ ✓ $= 8.7$ ✓✓ c

Ωm^{-1} or

$VA^{-1}m^{-1}$ ✓

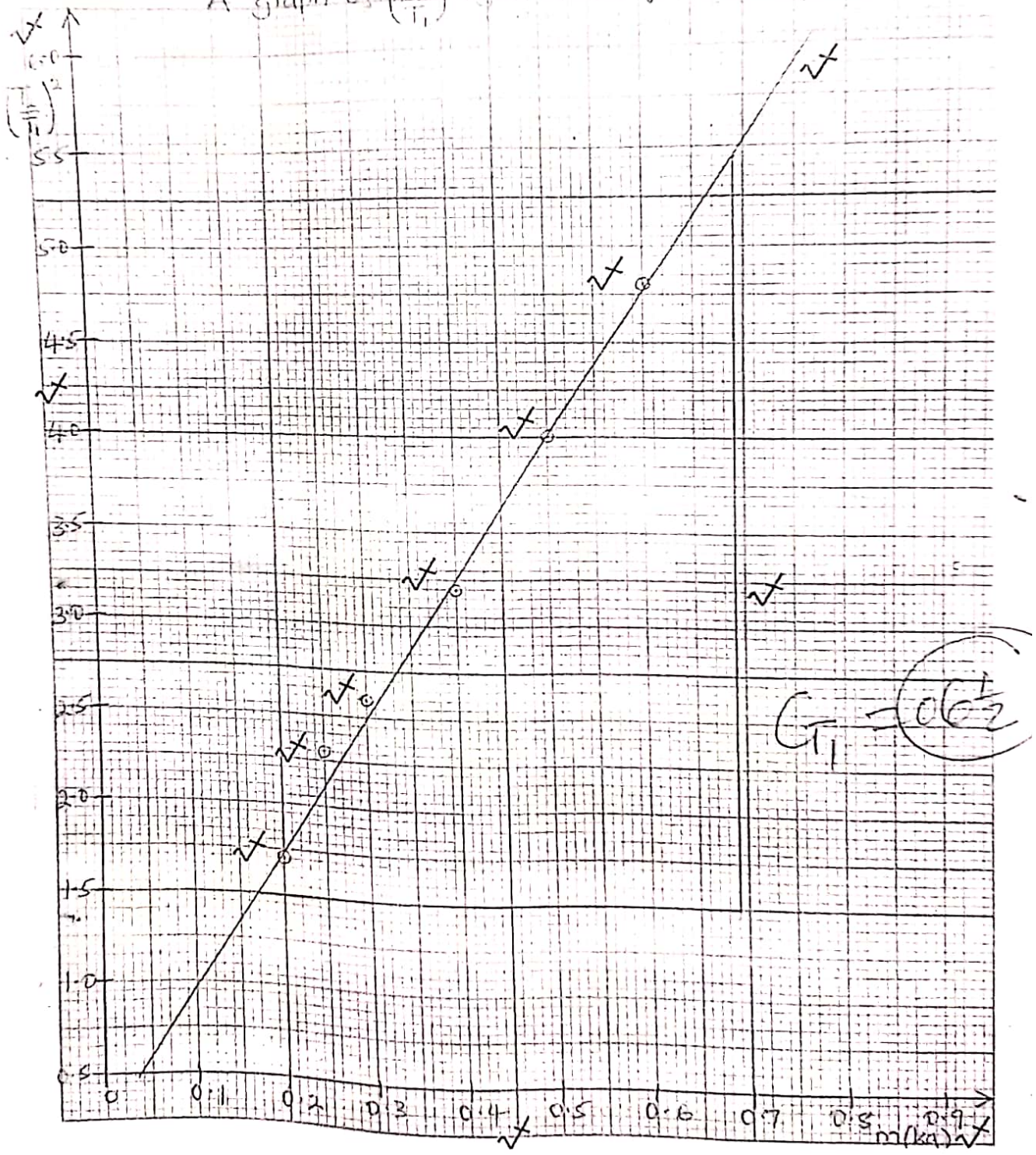
Precaution: - Firm connections

- Closing switch momentarily for a short time

Signature ..... Personal Number .....

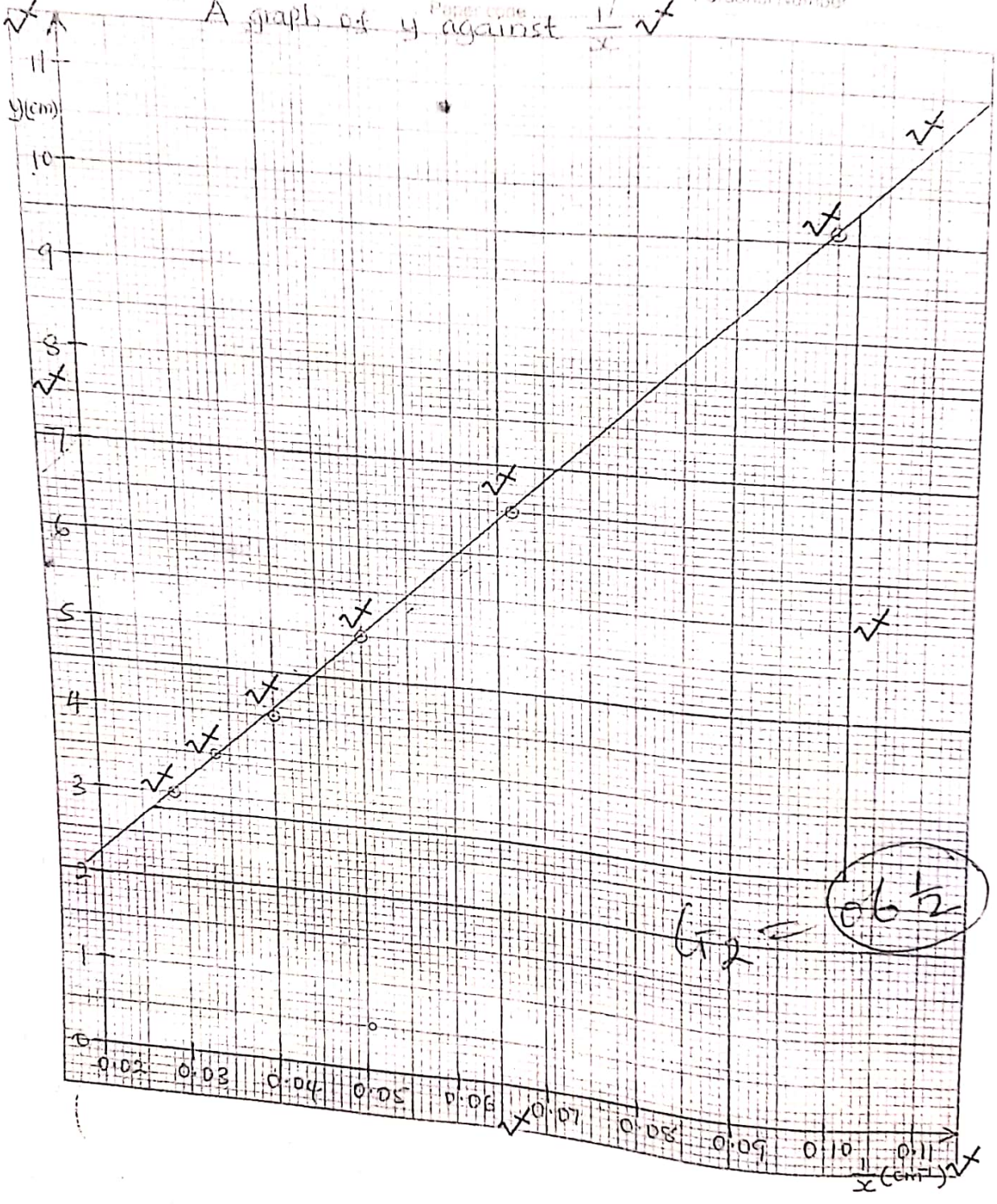
Subject Name ..... Center code .....

A graph of $\left(\frac{T_2}{T_1}\right)^2$ against m

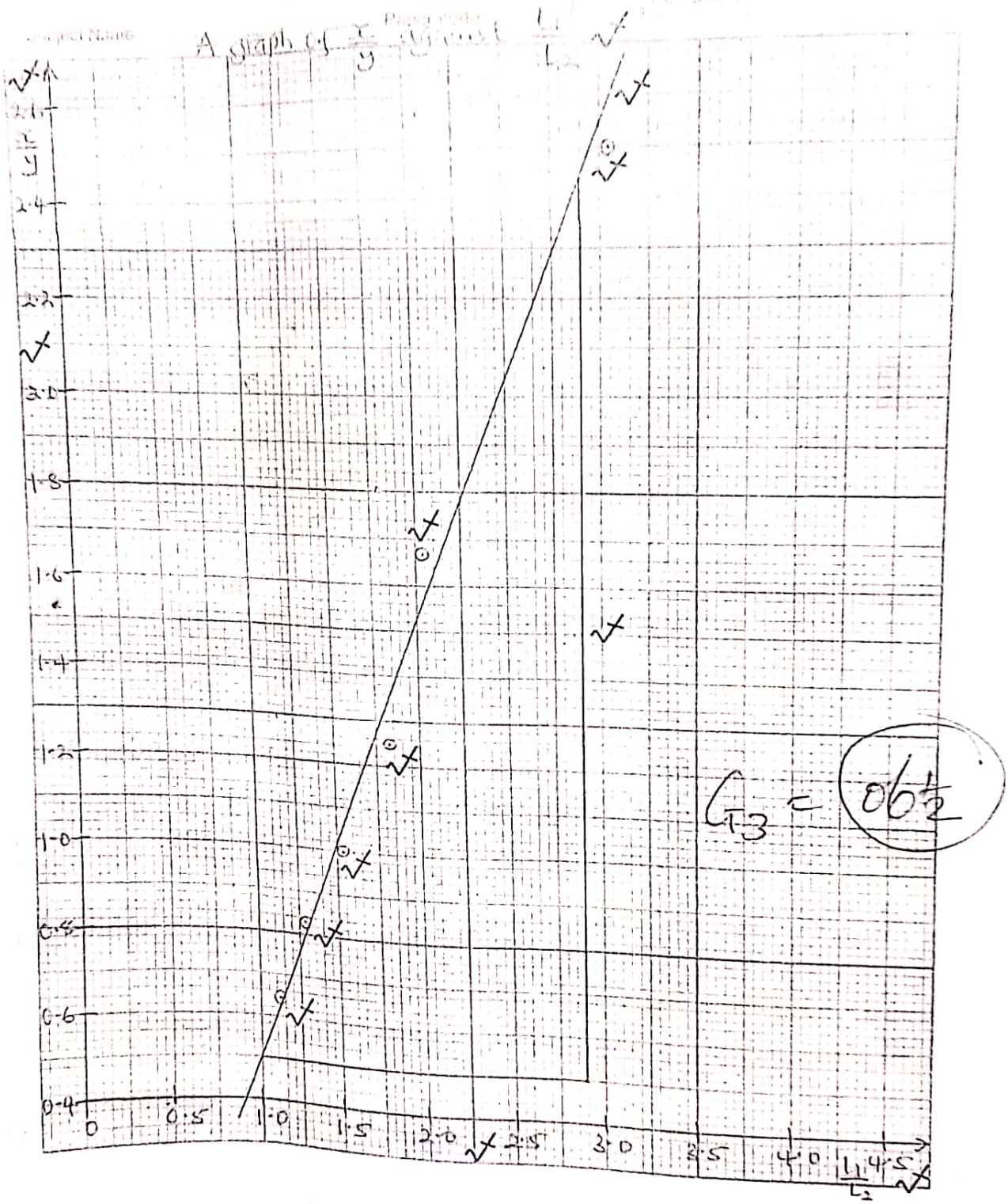


Subject Name Page No. Personal Number

A graph of y against $\frac{1}{x}$



$6\frac{1}{2}$


A graph of $\frac{L_1}{y}$ against $\frac{L_1}{L_2}$
$\frac{L_1}{y}$
2.4
2.2
2.1
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
$\frac{L_1}{L_2}$
$G_{T3} = 06\frac{1}{2}$

END.