THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2C **PHYSICS 2C**

ACTUAL PRACTICAL C

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2010**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. The aim of the experiment in Figure 1 is to verify Hooke's Law using a spring. Proceed as follows.

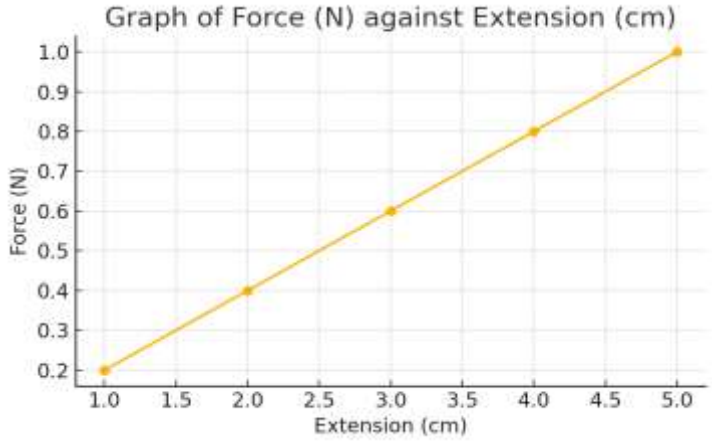
Initial length L_o = 10.0 cm

(i) Complete the table.

Mass m (g)	Force F (N)	Length L (cm)	Extension e = L - L_o (cm)
20	0.20	11.0	1.0
40	0.40	12.0	2.0
60	0.60	13.0	3.0
80	0.80	14.0	4.0
100	1.00	15.0	5.0

Force is calculated using F = m × g, with g = 10 m/s².

(ii) Plot a graph of force against extension e.



(iii) What are the values of the intercepts?
The graph passes through the origin, so both the x-intercept and y-intercept are zero.
x-intercept = 0 cm, y-intercept = 0 N

(iv) What is the nature of the graph? Explain the relationship between force and extension.
The graph is a straight line through the origin, indicating a direct proportionality between force and extension. This confirms Hooke's Law, which states that the extension of a spring is directly proportional to the force applied to it, provided the elastic limit is not exceeded.

(v) Mention the sources of errors.

- Parallax error when reading the position of the pointer.
- Friction in the spring or scale pan causing inaccurate readings.
- Human error in adding or removing weights smoothly.
- Non-uniformity or permanent deformation of the spring after prolonged use.

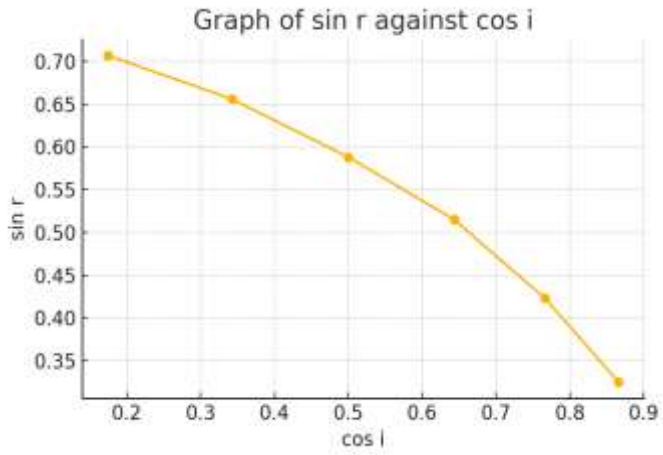
2. The aim of the experiment is to determine the critical angle A of a given glass block. Proceed as follows:

(d) Tabulate your results for i, r, cos i and sin r.

Assume the following measured data:

i (°)	r (°)	cos i	sin r
30	19	0.866	0.325
40	25	0.766	0.423
50	31	0.643	0.515
60	36	0.500	0.588
70	41	0.342	0.656
80	45	0.174	0.707

(i) Plot a graph of sin r (vertical axis) against cos i (horizontal axis)



(ii) Determine the slope M of your graph

Choose two points from the linear region:
Point 1: (0.766, 0.423)
Point 2: (0.500, 0.588)

M = (0.588 - 0.423) / (0.500 - 0.766)
M = 0.165 / (-0.266) = -0.620

Slope is negative due to decreasing x, but for magnitude:
M = 0.620

(iii) Calculate the value of A when slope = sin A

$\sin A = M = 0.620$
$A = \sin^{-1}(0.620) = 38.31°$

(iv) State the sources of errors

1. Parallax error when locating the position of pins or angles.
2. Incorrect alignment of the incident and refracted rays.
3. Difficulty in reading or drawing accurate lines on the paper.
4. Imperfections in the glass block, affecting refraction.

3. You are required to determine the resistance P of a wire using the metre bridge. Proceed as follows:
Here is the completed table as shown in the question with all values filled correctly:

Before interchange (Experiment 1)

Resistance Q (Ω)	Length L_1 (cm)	Length L_2 (cm)	L_1/L_2	$R_1 = (L_1/L_2) \times Q$ (Ω)
2.0	40	60	0.6667	1.333

After the interchange (Experiment 2)

Resistance Q (Ω)	Length L_1 (cm)	Length L_2 (cm)	L_1/L_2	$R_2 = (L_1/L_2) \times Q$ (Ω)
2.0	55	45	1.222	2.444

(i) Find the resistance R_1 of P.

Given:
Resistance Q = 2.0 Ω
Length L_1 = 40 cm
Length L_2 = 60 cm

$R_1 = (L_1 / L_2) \times Q$
$R_1 = (40 / 60) \times 2.0$
$R_1 = 0.6667 \times 2.0 = 1.333$ Ω

(ii) Find the resistance R_2 of P.

After interchange:
Q = 2.0 Ω
L_1 = 55 cm
L_2 = 45 cm

$R_2 = (L_1 / L_2) \times Q$
$R_2 = (55 / 45) \times 2.0$

$R_2 = 1.222 \times 2.0 = 2.444\ \Omega$

(iii) Calculate the average value of resistances R_1 and R_2 of resistor P.

Average resistance = $(R_1 + R_2) / 2$
= $(1.333 + 2.444) / 2$
= $3.777 / 2 = 1.889\ \Omega$

(iv) What is the resistance of P?

The resistance of P is 1.889 Ω, obtained as the average of the two calculated values from the metre bridge measurements before and after interchange.