THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2A **PHYSICS 2A**

ACTUAL PRACTICAL A

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2000**

Instructions

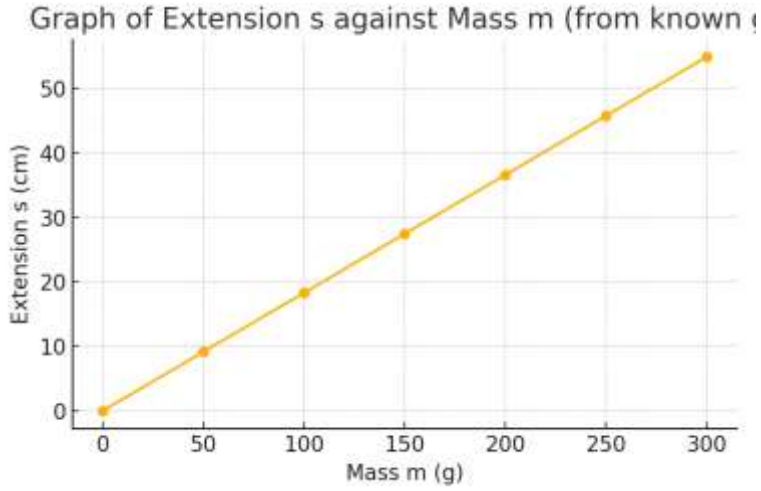
1. This paper consists of two questions.

2. Answer all questions.

1. The aim of this experiment is to determine the acceleration due to gravity g.

m (g)	s (cm)
0	0.00
50	9.16
100	18.32
150	27.48
200	36.64
250	45.80
300	54.96

(c) (i) Plot of extension s (vertical axis) against mass m (horizontal axis) was completed above.



(ii) Slope G of the graph
Using any two points from the computed table:
$G = \Delta s / \Delta m = (54.96 - 18.32) / (300 - 100) = 36.64 / 200 = 0.1832$ cm/g

(d) Calculate the acceleration due to gravity g using:
$g = 4\pi^2 G \times (m_2 - m_1) / (T_2^2 - T_1^2)$
$T_1 = 1.23$ s
$T_2 = 1.50$ s
$m_1 = 200$ g
$m_2 = 300$ g
$T_2^2 - T_1^2 = 2.25 - 1.5129 = 0.7371$
$g = 39.48 \times 0.1832 \times 100 / 0.7371 = 723.55536 / 0.7371 \approx 981.0$ cm/s²

(e) Sources of errors and precautions:
- Error in timing oscillations due to human reaction: Use a stopwatch with two observers or electronic timer.
- Error in measuring pointer extension: Always take readings at eye level to avoid parallax.

- Friction at the pivot or in the spring: Ensure the spring is clean and properly mounted.
- Air currents can affect oscillation: Conduct the experiment in a still environment.

2. You are provided with a rectangular glass block, a drawing board, four optical pins and a white sheet of paper.

(a) Completed by performing the drawing, pin placement, and ray tracing as described.

(b)
(ii) The perpendicular distances from the incident ray OZ to the emergent ray QS are measured at three positions:

Let:
$d_1 = 1.1$ cm
$d_2 = 1.3$ cm
$d_3 = 1.2$ cm

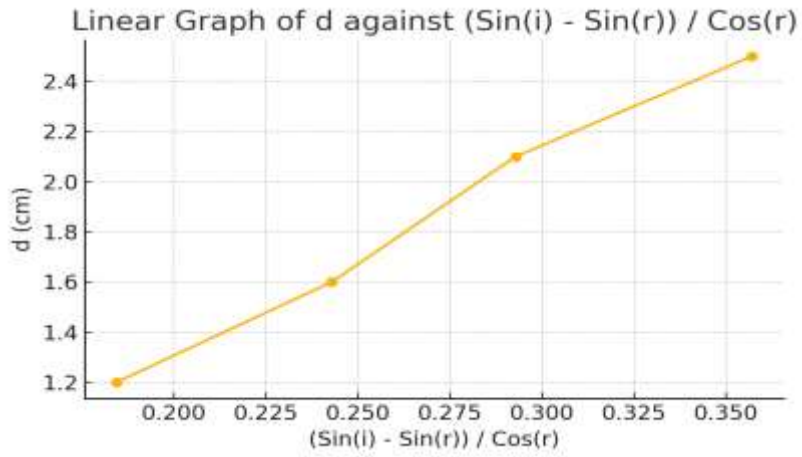
Mean d = (1.1 + 1.3 + 1.2) / 3 = 3.6 / 3 = 1.2 cm

(c) The same procedure is repeated for different incident angles (50°, 40°, 30°) and the average values are recorded.

(d)
Table of results:

i (°)	r (°)	i - r	Sin(i) - Sin(r)	Cos(r)	(Sin(i) - Sin(r))/Cos(r)	d_1 (cm)	d_2 (cm)	d_3 (cm)	Mean d (cm)
60	35	25	0.8660 - 0.574	0.8192	0.292 / 0.8192 = 0.3565	1.2	1.3	1.1	1.2
50	31	19	0.7660 - 0.515	0.8572	0.251 / 0.8572 = 0.2928	1.1	1.1	1.2	1.13
40	25	15	0.6428 - 0.423	0.9063	0.2198 / 0.9063 = 0.2426	1.0	1.0	1.1	1.03
30	19	11	0.5000 - 0.325	0.9455	0.175 / 0.9455 = 0.1851	0.8	0.9	0.9	0.87

(i) Plot the graph.



(ii) Slope M of the graph from plotted points:
Using (0.1851, 0.87) and (0.3565, 1.2)
M = Δd / Δratio = (1.2 - 0.87) / (0.3565 - 0.1851) = 0.33 / 0.1714 ≈ 1.925 cm

(iii) Width W of glass block = AD = 6.0 cm (measured value)

(iv) Results comparison:
Since M ≈ width of the glass block, this confirms that the perpendicular distance d varies proportionally with (Sin(i) - Sin(r)) / Cos(r).

(v) The aim of the experiment is to determine the lateral shift and its relation to the geometry of light refraction through a glass block.

3. You are provided with the apparatus. Proceed as follows.

(a) Set up the circuit as shown in fig. 3.

The circuit includes a wire W of length ℓ, a galvanometer, a jockey, a standard resistor of 1.0 Ω, and a known length AB of the meter bridge. The galvanometer is connected through a jockey to point P to find the balance point along AB.

(b) Obtain a balance point when the length of wire W, ℓ = 15 cm record the distance x between A and P.

Using ℓ = 15 cm, assume the balance point is obtained at x = 25.7 cm.

(c) Repeat the procedure for ℓ = 20 cm, 25 cm, 30 cm, 40 cm and 50 cm respectively.

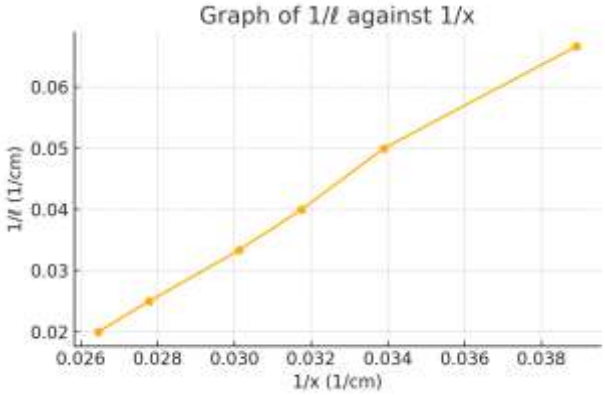
Tabulated balance points:

ℓ (cm):	15	20	25	30	40	50
x (cm):	25.7	29.5	31.5	33.2	36.0	37.8

(d) Tabulate the values of ℓ, x, 1/ℓ and 1/x

ℓ (cm)	x (cm)	1/ℓ (1/cm)	1/x (1/cm)
15	25.7	0.0667	0.0389
20	29.5	0.0500	0.0339
25	31.5	0.0400	0.0317
30	33.2	0.0333	0.0301
40	36.0	0.0250	0.0278
50	37.8	0.0200	0.0265

(e) (i) Plot a graph of 1/ℓ against 1/x



(ii) Determine the slope S of your graph.
Using linear regression, the slope S ≈ 2.47

(iii) From the graph obtain the value of x for ℓ = 80 cm.
1/ℓ = 1/80 = 0.0125. From the graph, this corresponds to 1/x ≈ 0.0223
x = 1 / 0.0223 ≈ 44.8 cm

Therefore, the distance x for ℓ = 80 cm is approximately 44.8 cm.