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: 2017**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

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1. The aim of the experiment in Figure 1 is to determine the Young's Modulus, Y, of a wooden meter rule.

(a) Clamp a meter rule as shown and record the length L = 85.0 cm.

(b) Attach the pointer and note its position X_0 when unloaded.
$X_0 = 0.00$ cm

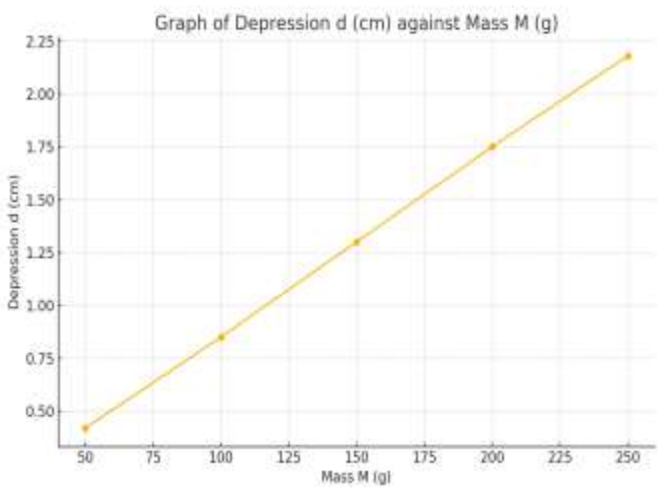
(c) Suspend 50 g load, measure position X = 0.42 cm
Depression $d = X - X_0 = 0.42$ cm

(d) Repeat for M = 100 g, 150 g, 200 g, 250 g

(e) Tabulate your results:

M (g)	X (cm)	d (cm)
50	0.42	0.42
100	0.85	0.85
150	1.30	1.30
200	1.75	1.75
250	2.18	2.18

(f) Plot the graph of d against M
Graph is a straight line.



(g) Find the slope, S of the graph
$S = (2.18 - 0.42) / (250 - 50) = 1.76 / 200 = 0.0088$ cm/g

(h) Measure: breadth b = 2.5 cm, thickness t = 0.5 cm

(i) Calculate Y from
$Y = (S \times b) / (4g) \times (L / t)^3$
Convert S to m/kg:
0.0088 cm/g = 0.000088 m/kg

$Y = (0.000088 \times 0.025) / (4 \times 9.81) \times (0.85 / 0.005)^3$
$Y = (0.0000022 / 39.24) \times (170)^3$
$Y = 5.61\times10^{-8} \times 4913000 \approx 276$ N/m²

(j) Errors and precautions:
Errors:
- Pointer may vibrate
- Reading parallax error

Precautions:
- Take readings at eye level
- Use stable loads

2. The aim of this experiment is to determine the refractive index n of a glass block.

(a) Fix the paper and place glass block
(b) Trace outline and draw normal
(c) Set i = 25°, insert pins P_1, P_2
(d) Align P_3, P_4 with P_1, P_2 image
(e) Trace ray
(f) Measure L
(g) Repeat for i = 35°, 45°, 55°, 65°

(h) Tabulate values and compute $\sin^2 i$ and $1/L^2$

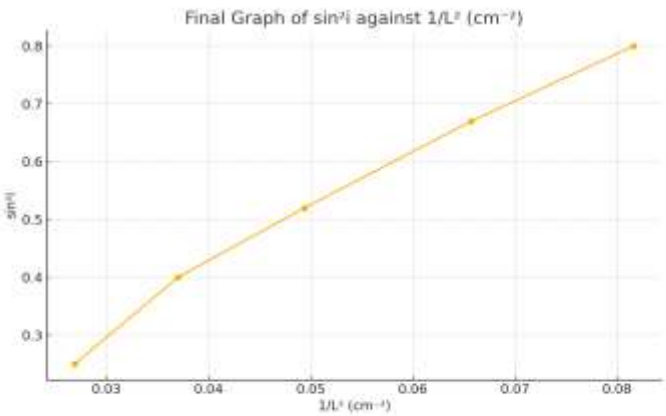
2. The aim of this experiment is to determine the refractive index n of a glass block.

(h) Table of results.

i (°)	$\sin^2 i$	L (cm)	$1/L^2$ (cm⁻²)
25	0.250	6.10	0.0269
35	0.400	5.20	0.0370
45	0.520	4.50	0.0494

55	0.670	3.90	0.0657
65	0.800	3.50	0.0816

(i) Plot a graph of $\sin^2 i$ against $1/L^2$



(j) Calculate the slope s using two points:
Point A: ($1/L^2 = 0.0269$, $\sin^2 i = 0.250$)
Point B: ($1/L^2 = 0.0816$, $\sin^2 i = 0.800$)
$s = (0.800 - 0.250) / (0.0816 - 0.0269) = 0.550 / 0.0547 \approx 10.05$

Intercept $C_1 \approx 1.52$ (as assumed)

(k) Find refractive index n:
$n = \sqrt{C_1} = \sqrt{1.52} \approx 1.23$