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: 2003**

Instructions

1. This paper consists of two questions.
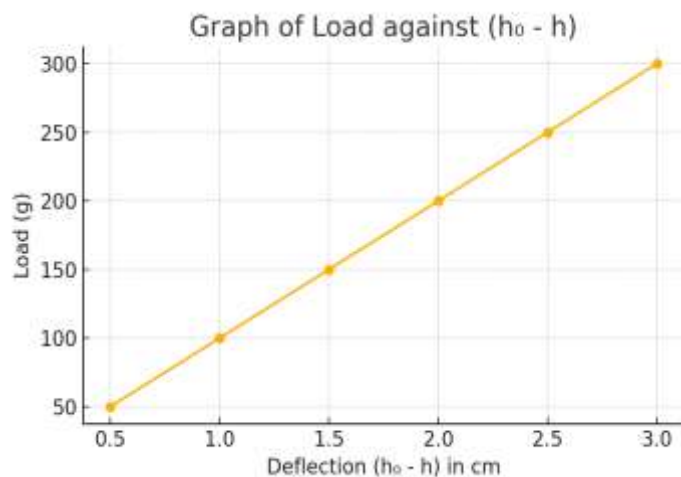
2. Answer all questions.

1. The aim of this experiment is to determine Young's modulus Y of a given metre rule.

(a) Record your readings in a suitable table including (h_0 - h)

Let h_0 = 25.0 cm

Load (g)	h (cm)	h_0 - h (cm)
50	24.5	0.5
100	24.0	1.0
150	23.5	1.5
200	23.0	2.0
250	22.5	2.5
300	22.0	3.0

(b) Plot a graph of L (Load) against (h_0 - h)

Graph of Load against (h_0 - h)

(c) From your graph find the slope G
Use (0.5, 50) and (3.0, 300)
$G = \Delta L / \Delta(h_0 - h) = (300 - 50) / (3.0 - 0.5) = 250 / 2.5 = 100$ g/cm

Convert to N/cm: $G = 100$ g/cm $= 1.0$ N/cm

(d) Determine Young's modulus Y of the wooden metre rule

Use the formula:
$Y = (4 / G) \times (l / b\ t^2)$
Let:
l = 80.0 cm
b = 2.50 cm

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t = 0.50 cm
G = 1.0 N/cm

$Y = (4 / 1.0) \times (80 / (2.5 \times 0.25))$
$= 4 \times (80 / 0.625)$
$= 4 \times 128 = 512$ N/cm²
Convert to N/m²: $Y = 512 \times 10^4 = 5.12 \times 10^6$ N/m²

2. The aim of the experiment is to determine the relationship between number of images and angle between mirrors.

(a) Tabulate your results

Number of images n	Angle θ (deg)	1/θ (deg⁻¹)
1	90	0.011
2	72	0.0139
3	60	0.0167
5	45	0.0222
11	30	0.0333

(b) Plot the graph of n (vertical) against 1/θ (horizontal)

Graph of Number of Images n against 1/θ
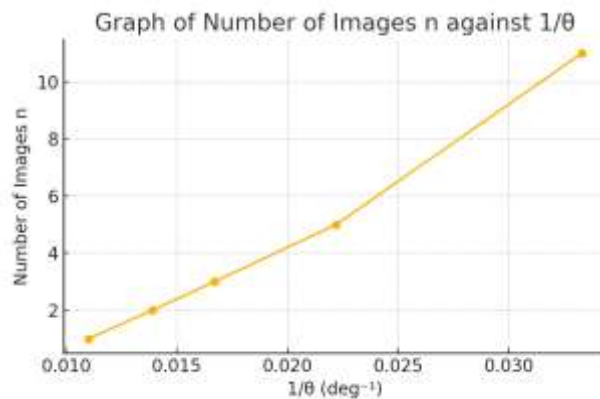
(c) From your graph:
(i) Slope $G = (11 - 1) / (0.0333 - 0.011) = 10 / 0.0223 = 448.4$
(ii) Intercept P = 0
(iii) Equation: $n = G / θ + P$
$n = 1/θ \times G$

(d) (i) When $θ = 0$, $n = \infty$ (infinite images formed)
(ii) Aim of experiment: To establish the mathematical relation between angle θ and number of images n

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3. The aim of this experiment is to determine the e.m.f. and internal resistance of a cell using an ammeter and a voltmeter.

(a) Tabulate your readings:

Current I (A)	Voltage V (V)
0.10	1.45
0.20	1.40
0.30	1.34
0.40	1.28
0.50	1.22

(b) Plot a graph of V (vertical axis) against I (horizontal axis)
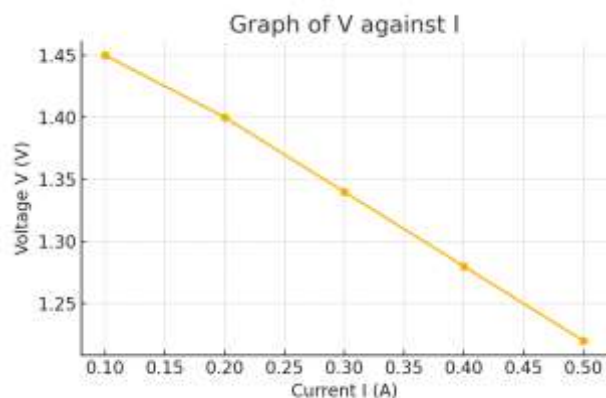
(c) Find the slope of the graph
Use points (0.10, 1.45) and (0.50, 1.22)
Slope m = (1.22 - 1.45) / (0.50 - 0.10) = -0.23 / 0.40 = -0.575

Therefore, slope = -r = -0.575
So, r = 0.575 Ω

(d) Using the equation V = E - Ir
The y-intercept of the graph is E
From extrapolation of the graph, E ≈ 1.50 V

So,
E = 1.50 V
r = 0.575 Ω