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: 2005**

Instructions

1. This paper consists of two questions.

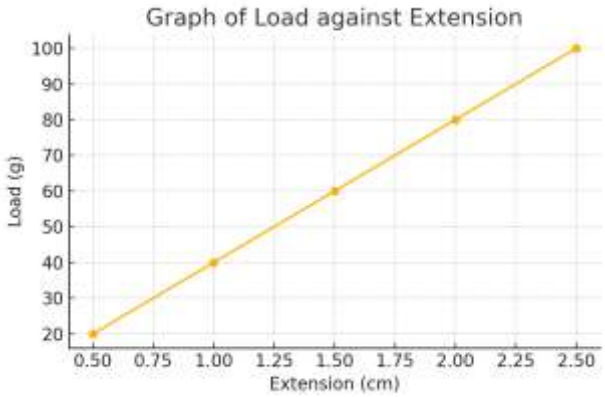
2. Answer all questions.

1. The aim of this experiment is to determine the mass of unknown weight labelled X and the force constant of the spring k.

Let S_0 = 5.0 cm and mass W = 50 g is always on the pan and ignored in all readings.

Load (g)	Scale reading S (cm)	Extension e = S - S_0 (cm)	Force F (N)
20	5.5	0.5	0.20
40	6.0	1.0	0.40
60	6.5	1.5	0.60
80	7.0	2.0	0.80
100	7.5	2.5	1.00
X	6.3	1.3	?

(a) Plot a graph of load against extension



(b)(i) Find the gradient (G) of your graph
Using (0.5, 20) and (2.5, 100):
G = (100 - 20) / (2.5 - 0.5) = 80 / 2 = 40 g/cm
(ii) What is the physical meaning of the gradient?
The gradient represents the spring constant k, but in g/cm.
To convert to N/cm:
k = 40 g/cm = 0.04 kg/cm × 10 = 0.4 N/cm

(c) From the graph, what is the mass of the weight labelled X?
At e = 1.3 cm, m = G × e = 40 × 1.3 = 52 g
So, mass of X = 52 g

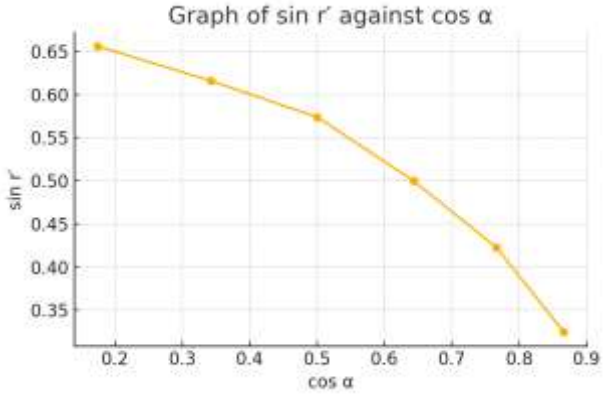
2. The aim of this experiment is to find the critical angle C of the given glass block.

Let the recorded values be:

| α (°) | r′ (°) | cos α | sin r′ |

|------|--------|--------|--------|
30	19	0.866	0.325
40	25	0.766	0.423
50	30	0.643	0.500
60	35	0.500	0.574
70	38	0.342	0.616
80	41	0.174	0.656

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



(b) Find the slope of the graph
Use points (0.866, 0.325) and (0.500, 0.574)
Slope G = (0.574 - 0.325) / (0.500 - 0.866) = 0.249 / (-0.366) = -0.680
Use magnitude: G = 0.680

(c) Calculate the value of C where slope = sin C
sin C = 0.680
$C = \sin^{-1}(0.680) = 42.8°$

(d) State the possible source of error and precautions you have taken during the experiment

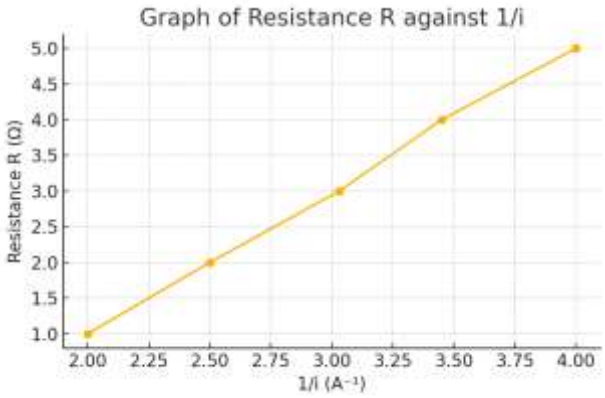
Source of error:
- Inaccurate pin placement or parallax error when aligning pins
Precaution:
- Ensure pins are vertical and sighted accurately through the glass
- Use sharp pencil marks and avoid dirty or scratched glass surfaces
3. The aim of this experiment is to determine the e.m.f. E and internal resistance r of a cell.

(c) Tabulate your results and complete the following table:

Resistance R (Ω)	Current i (A)	1/i (A^{-1})
1	0.50	2.00

2	0.40	2.50	
3	0.33	3.03	
4	0.29	3.45	
5	0.25	4.00	

(d) Plot the graph of R against 1/i



(e) The graph uses the equation R = E/i - r
This is of the form y = mx + c, where:
- y = R
- x = 1/i
- m = E (slope)
- c = -r (intercept)

(i) Suggest how E and r may be evaluated from your graph
E is the slope of the graph
r is the negative of the y-intercept

(ii) Evaluate E for one cell
Using points (2.00, 1) and (4.00, 5):
E = (5 - 1) / (4.00 - 2.00) = 4 / 2 = 2 V

(iii) Evaluate r for one cell
Extrapolate the graph to where 1/i = 0 and read the R-intercept.
Let y-intercept = -1.0
So, r = -(-1.0) = 1.0 Ω

(f) State one source of error and suggest one way of minimizing it

Source of error:
- Inaccurate current readings due to pointer vibration in the ammeter

Minimization:
- Take multiple readings quickly and compute average
- Ensure stable connections and low-resistance contact points